Instruction manual

RS232 interface
With FLOW-BUS protocol
for digital
Mass Flow / Pressure instruments

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ATTENTION
Please read this instruction manual carefully before installing and operating the instrument.
Not following the guidelines could result in personal injury and/or damage to the equipment.

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SCOPE OF THIS MANUAL

This manual covers the interface part of digital massflow / pressure instruments for gases or liquids. It describes the communication between the instrument and the operator according to the specific (fieldbus) protocol.
More information can be found in other documents.

Multibus instruments have modular instruction manuals consisting of:

- General instructions digital Mass Flow / Pressure instruments laboratory style / IN-FLOW (document nr. 9.17.022)

- General instructions CORI-FLOW (document nr. 9.17.031)

- Operation instructions digital instruments (document nr. 9.17.023)

- Fieldbus/interface description:

Short form start-up

All necessary settings for this module are already performed at Bronkhorst High-Tech B.V.
To follow next steps carefully is the quickest way to get this module operational in your own system.

Procedure:

- **Make sure your PC or PLC is connected to the RS232 interface by means of the correct cable**

  - **Multibus instruments need a special cable with T-connector.**
  - **RS232/FLOW-BUS interfaces need a one-on-one 9-pole cable without crossings with male and female connector**
  - **Cable lengths for RS232 must not exceed 10 meters.**

- **Make sure instrument or interface is powered (+15Vdc or +24Vdc)**

- **In case of RS232/FLOW-BUS interface without micro-switch and LED's, first see that interface gets a free address on the FLOW-BUS. Follow initialisation procedure described at [**Initialising RS232/FLOW-BUS interface]

- **Use settings [38400,n,8,1] for your COM-port: Baudrate = 38K4 Baud, no parity, 8 databits, 1 stopbit.**

- **Start sending messages as described in following paragraphs.**

- **In case of trouble programs like Hyperterminal (available in MS-Windows) or FlowDDE (from Bronkhorst High-Tech B.V.) could be very useful.**

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Appendices

1 INTRODUCTION

This manual will explain how to communicate with a Bronkhorst High-Tech instrument to your PC/PLC using RS232 serial communication. You have to write software yourself using the information of this document in order to be able to operate these instruments.

Bronkhorst High-Tech B.V. also offers software to support a quicker way to operate digital instruments with your PC using MS-Windows 95, 98, NT, 2000 or XP

On the highest supported communication level, you may use DDE-channels for Windows application-programs with this facility. You can use the program FlowDDE for easy connection between MS-Windows applications (e.g. Excel, Visual Basic, LabView, Delphi, Borlandc) and digital instruments.
There are several examples available for LabView, Visual Basic and Excel environments.

On a lower communication level, you can also use the FLOWB32.DLL for reading/changing parameter values.

To read and write parameter values from or to FLOW-BUS devices directly through the available interfaces there is a special protocol for messages between these devices.
This protocol has been specially developed for Bronkhorst High-Tech equipment so no third party equipment can be connected.
It consists of a hierarchical setup for instruments/**nodes** (max. 128) containing **processes** (max. 128) with **parameters(FBnr)** (max. 32) which **values** can be set to certain values to enable settings/properties for the instruments.

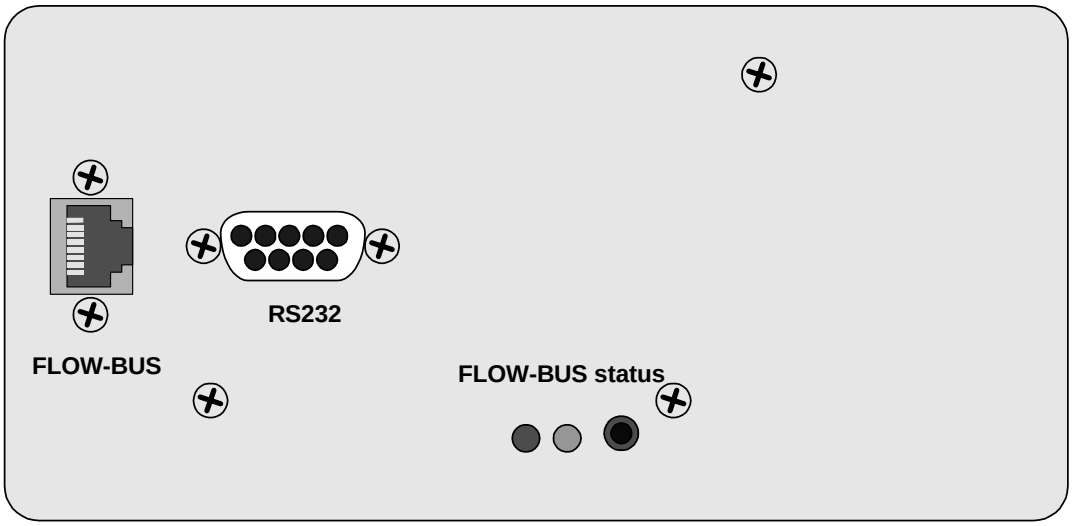
When operating a FLOW-BUS system with a HOST computer, you need to know this message protocol if you choose to drive the interfaces directly.

When you use a RS232/FLOW-BUS interface (without the micro-switch and 2 LED's), you first have to initialise the interface. This can be done by means of sending some ASCII-strings to the interface through RS232. See chapter 3 for more details.
When you communicate directly via RS232 on a multibus instrument or when you use a new type of RS232/FLOW-BUS (baudrates up to 38K4 with switch and 2 LED's) interface, no special initialisation is needed.

2 Available interfaces

2.1 RS232/FLOW-BUS interface

The RS232/FLOW-BUS interface is an interface between the FLOW-BUS and the RS232 V24 serial (computer) port.
It will either be supplied as a separate enclosed unit with a FLOW-BUS connector and a RS232 connector or as an integral 14TE module of your E-7000 readout and control system.
The converter offers communication with a baudrate up to 38,4 kBaud.
Communication software support is available. Communication settings are: 38400,n,8,1.



2.1.1 D-connector for RS232

The female RS232 (x) (subminiature 9-pin) D-connector has the following pin configuration:

Pinnumber	Description
1	not connected
2	TXD
3	RXD
4	not connected
5	0 Vd
6	DTR
7	CTS
8	RTS
9	Shield

2.1.2 Specifications

Power supply	+15Vdc/+24Vdc +/- 10%
Power consumption	+15Vdc : 50 mA +24Vdc : 35 mA
Operating temperature	0…+50 ºC
Storing temperature	-20…+60 ºC
Housing dimensions	box: 160x80x44mm module: 14TE
Baudrates	4800 Baud 9600 Baud 19200 Baud 38400 Baud
Galvanic Isolation	FLOW-BUS: opto isolated Power : DC-DC converter

2.2 RS232 on multibus instrument

The RS232 interface on a multibus instrument can be connected to any RS232 V24 serial (computer) port.
The interface offers communication with a baudrate of 38.4 kBaud.
On the 9-pin male subD connector of the instrument RX and TX are available on pin 6 and pin 1.

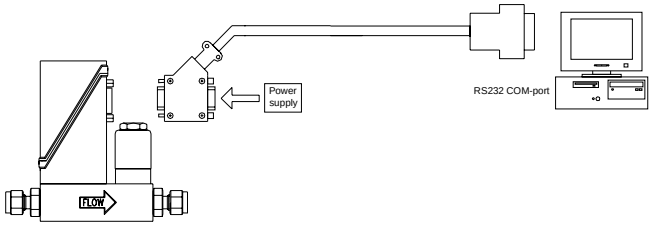
RS232 communication is possible by:
- 9-pin Sub D-connector (non IP65 applications, e.g. EL-FLOW)
- 8 DIN connector (IP65 applications, e.g. CORI-FLOW)

For the exact connections please advise your hook-up diagram.

Non IP65 applications, e.g. EL-FLOW

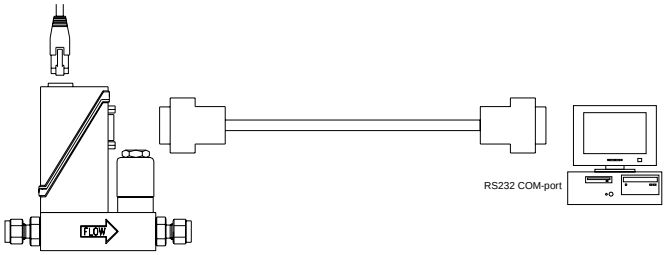
Analog I/O, without businterface

Instrument is supplied through
9-pin Sub D-connector.



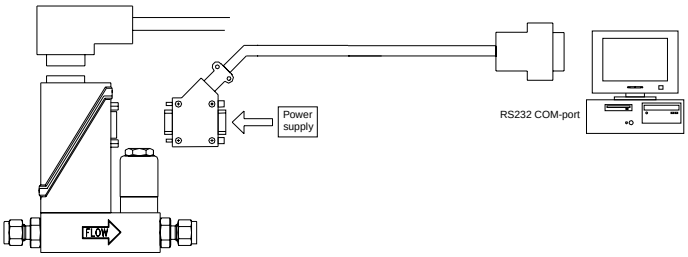
Application with businterface FLOW-BUS/DeviceNet

Instrument is supplied through the bus.



Application with businterface PROFIBUS

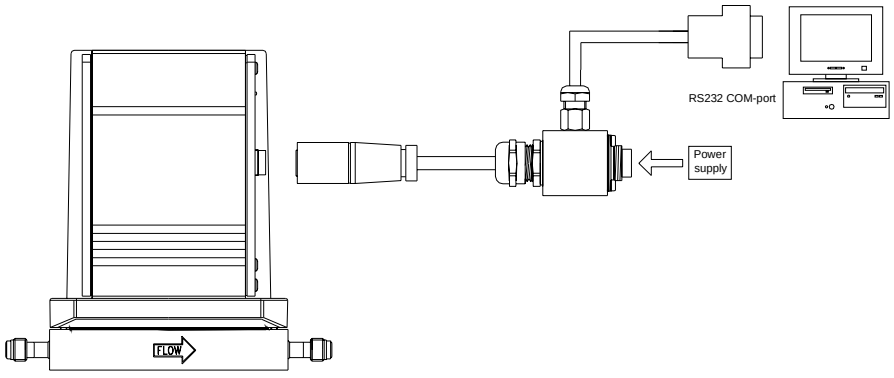
Instrument is supplied through
9-pin Sub D-connector.



IP65 applications, e.g. CORI-FLOW

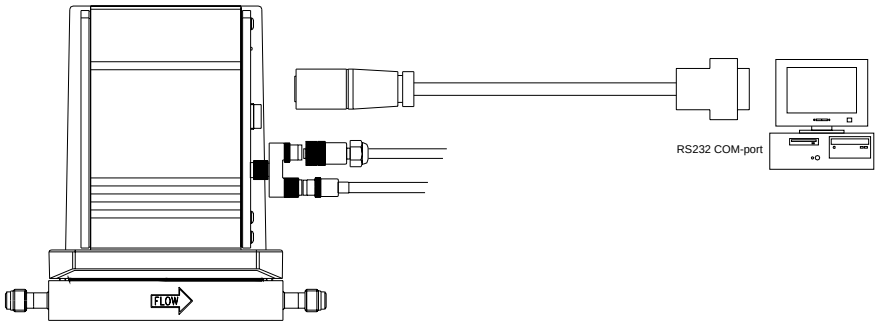
Analog I/O, without businterface

Instrument is supplied through
8 DIN connector.



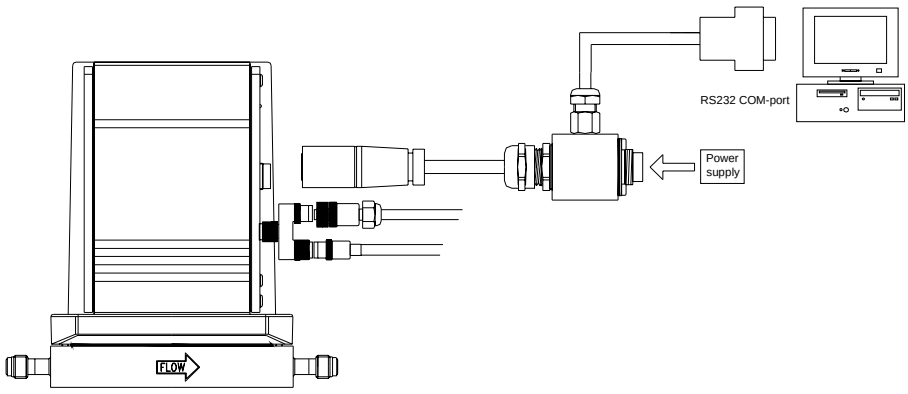
Application with businterface FLOW-BUS/DeviceNet

Instrument is supplied
through the bus.



Application with businterface PROFIBUS

Instrument is supplied through
8 DIN connector.



2.2.1 Facilities

No handshaking facilities are used. On the side of the PC/PLC a nul-modem connector is needed.
Communication settings are: 38400,n,8,1.
Bronkhorst High-Tech B.V. offers a special cable needed for communication.
Communication software support is available.

2.2.2 Specifications multibus RS232:

Operating temperature	0…+70 ºC
Storing temperature	-20…+60 ºC
Baudrates	38400 Baud
Galvanic Isolation	not for RS232

The multibus RS232 interface is a serial interface between the multibus instrument and the RS232 V24 serial (computer) port using the FLOW-BUS protocol for communication.
This means that for serial RS232 communication a multibus instrument with RS232 can be treated as a FLOW-BUS system with one instrument and a FLOW-BUS/RS232 interface.
All available software already existing for FLOW-BUS RS232 communication can be used for multibus instruments also. Only initialisation is different. Use of FLOWDDE32 is only possible from V4.23 and higher.

3 FLOW-BUS protocol description

3.1 General

On the highest supported communication level, you may use DDE-channels for Windows application-programs with this facility.

On a lower communication level, you can use the FLOWB32.DLL, for changing parameter values.

To read and write parameter values from or to FLOW-BUS devices directly through the available interfaces there is a special protocol for messages between these devices. When operating a FLOW-BUS system with a HOST computer, you need to know this message protocol if you choose to drive the interfaces directly.

When you use a type of RS232/FLOW-BUS interface (baudrate up to 38K4) you may first have to initialise the interface. This can be done by means of sending some ASCII-strings to the interface through RS232. See also paragraph 3.2.

There are two different communication protocols for the PC and the RS232 HOST:

- an ASCII protocol for communication that is compatible with existing Flowbus applications. This protocol serves only one master/slave dialog at a time.

- an enhanced binary protocol that supports concurrent sending of messages to different nodes. This protocol contains a message-sequence number an serves more than one master/slave dialogs at a time.

The RS232-HOST module automatically recognises the protocol used by the PC and adapts its behaviour to the protocol in use. The type of protocol is determined by the first character of a message.

- the first character is >:= (0x3A) existing type of message.

- the first character is DLE (0x10) enhanced type of message.

Via the FLOW-BUS DLL (FLOWB32.DLL)The PC determines which protocol is in use.

The communication relation is always master (PC) and slave (HOST). The HOST will always respond on a request from the PC.

3.2 Initialisation of local host interfaces on Multibus instruments

When you use a digital instrument with RS232 interface, baudrate is fixed on 38K4 baud and no special initialisation is needed. Through the serial line connected to a COM-port of your computer or to a PLC you have to communicate with the instrument using the FLOW-BUS protocol.
Each instrument has its own node-address (3...120). If you want to send a message to the instrument you have to know this node-address. However, if you send a message to node-address 128 the instrument will always respond to your message. On a point-to-point connection like RS232 it is the easiest way to make the communication work under all circumstances (its independent of the real node-address of the instrument).

3.3 Interface structure

3.3.1 Basic datalink format

The basic datalink message format has the following fields:

node	message destination

length	data field length

data	data	Data	etc.

In the Flowbus environment the data field may contain up to 256 bytes of data. In the HOST application described here, the messages are according to PROPAR coding rules and the data field will contain a maximum of 64 bytes.

3.3.2 RS232 ASCII protocol

An ASCII protocol is used on the existing RS232-HOST. To be compatible with existing driver software the ASCII protocol is available.

A basic datalink message is coded in ASCII as follows:

	len		node				data				
:	len1	len2	node1	node2			data1	data2			CR

>**:**= (semicolon)	initial character
len1, len2	length of message including the node address in *bytes*, so (len1,len2) is the basic message length +1.
node1, node2	node address of destination (PC to HOST) node address of source (HOST to PC)
data1, data2	message field
CR	termination character

All bytes (except the initial and termination character) are converted from 1 binary byte to 2 hexadecimal bytes in ASCII representation.

Example: binary data byte 0x2A --> hexadecimal ASCII characters 0x32, 0x41.

A special message type is used to pass error messages from the HOST to the PC. Its structure is as follows:

	0x01		error		
:	0x30	0x31	error1	error2	CR

>**:**= (semicolon)	initial character
0x30, 0x31	length of the message (1 byte)
error	error code, two digit HEX number
CR	termination character

The error code can have the following values:

Value	Meaning
1	no >:= at the start of the message
2	error in first byte
3	error in second byte or number of bytes is 0 or message to long
4	error in received message (receiver overrun, framing error etc.)
5	Flowbus communication error: timeout or message rejected by receiver
8	time out during sending
9	no answer received within time out

3.3.3 Enhanced binary protocol

Binary coding and control sequences

The enhanced protocol is binary coded. Control sequences are used to recognise the begin and end of a message in a byte stream. A control sequence starts with a DLE byte (0x10) and is followed by a control byte. The following control sequences are defined:

First byte	Second byte	Function
DLE (0x10)	STX (0x02)	Start of message
DLE (0x10)	ETX (0x03)	End of message
DLE (0x10)	DLE (0x10)	Data byte 0x10
DLE (0x10)	any other character	Not allowed. Messages that contain such a sequence will be ignored. The receiver waits until a new DLE STX sequence.

The [DLE DLE] sequence is used to prevent possible DLE bytes in the transmitted binary data stream from being recognised as the start of a control sequence. The sender replaces any DLE bytes in the data by two DLE bytes. The datalink of the receiver will convert a [DLE DLE] sequences to one DLE byte.

Note: If a RS232 error (receiver overrun, framing error, not allowed control sequence) occurs, the datalink frame is ignored.

Enhanced message coding

The enhanced binary coded messages between PC and HOST are structured as follows:

DLE	STX	seq	node	len			data			DLE	ETX

DLE, STX start sequence
seq message sequence number
node node address of destination (PC to HOST)
node address of source (HOST to PC)
len length of data field in bytes
data message field
DLE, ETX end sequence

The enhanced protocol allows the transmission of more than one request at a time. The sequence number makes it possible to associate the answer to the according request. The HOST has more than one message buffer where messages may be stored (typical 5). When the message buffers are full, the HOST responds with an error message.

The responses from the HOST to the PC have the same message format as the request. An error message has a special format:

DLE	STX	seq	node	0x00	error	DLE	ETX

DLE, STX start sequence
seq message sequence number, as in request
node node address of source, as in request
error error code
DLE, ETX end sequence

The error code can have the following values:

Value	Meaning
3	Message rejected by HOST, host receiver buffer overflow
5	Flowbus communication error: timeout or message rejected by Flowbus node
8	time out during sending
9	no response on a request received within time out

3.4 Communication messages

Communication messages between FLOW-BUS interfaces and other devices consist of command strings with specific information. This command string is either ASCII (RS232) or BINARY. Basically the string contains several information bytes. Through RS232 these hexadecimal bytes are converted in ASCII (f.i.: bytevalue 0x0A is "0A" in ASCII and capital letters should be used). Messages via RS232 are preceded by the ':' character and terminated with "\r\n" (Carriage return-Line-feed).

There are several COMMANDS available in the FLOW-BUS messages. However only Command RD (04) and WR (01) are enough to do all the standard parameter reading and writing. A RD command will be answered with a WR command, containing the value asked for or a status message, containing an error-number. A WR command will be answered with a status message, containing an error-number (if error-number = 0, than WR command was OK).

Note:
ASCII character ':' has hexadecimal value: 3A
ASCII character '\r' has hexadecimal value: 0D
ASCII character '\n' has hexadecimal value: 0A

Communication commands

Command	Description
00	Status message
01	Send parameter with destination address, will be answered with type 00 command
02	Send parameter with destination address, no status requested
03	Send parameter with source address, no status requested
04	Request parameter, will be answered with type 02 or 00 command
05	Instruction: send parameter repeatedly (followed by byte with repeating time)
06	Stop process
07	Start process
08	Claim process
09	Unclaim process

To access a specific parameter you need to know the following numbers.

1. Node-address, each FLOW-BUS device is connected to a specific node-address in the system.
2. Process number, each device (node) consists of several processes.
3. Parameter number(FBnr), each process consists of several parameters.
4. Parameter type, each parameter can be of a different type and value.

For parameters numbers and values see tables "parameter properties" and "parameter values" in this manual.

Parameter types

Type	Id	Bytes	Range
Character	00h	1	0…255
Integer	20h	2	0…65535
Float	40h	4	+-1.18e-38...+-3.39e+38
Long	40h	4	4 bytes 0... 4294967296
String	60h	X	length needs to be specified

3.5 Chaining

Chaining can be used to send or request more than one parameter per message. When the parameters are all members of the same process, they can be chained at parameter level. When the parameters are members of different processes, they can be chained at process level. A combination is also possible.
For chaining at parameter level the first bit of the parameter number should be set if there is following another parameter at the same process. For chaining at process level the first bit of the process number should be set if there is another process following.

3.6 Status message

status

Nr	Byte	Description
0	:	Start character
1	04	Fixed message length 4.
2	Node	Node address
3	00	Command status
4	Status	00 No error 01 Process claimed 02 Command error 03 Process error 04 Parameter error 05 Parameter type error 06 Parameter value error 07 Network not active 08 Time-out start character 09 Time-out serial line 0A Hardware memory error 0B Node number error 0C General communication error 0D Read only parameter. 0E Error PC-communication 0F No RS232 connection 10 PC out of memory 11 Write only parameter 12 System configuration unknown 13 No free node address 14 Wrong interface type 15 Error serial port connection 16 Error opening communication 17 Communication error 18 Error interface busmaster 19 Timeout answer 1A No start character 1B Error first digit 1C Buffer overflow in host 1D Buffer overflow 1E No answer found 1F Error closing communication 20 Synchronisation error 21 Send error 22 Protocol error 23 Buffer overflow in module
5	Index or Claimed process	Index pointing to the first byte in the send message for which the above status applies. In case of the status CLAIM ERROR, this field contains the claimed process.
6	'\r'	Carriage Return
7	'\n'	Line Feed

***Note: Value from byte 5 of status message may be neglected if value of byte 4 = 0 !**

3.7 Send parameters

Send

Nr	Byte	Layout	Description	
0	:		start character	
1	Length		Message length	
2	Node		Node address	
3	01 or 02		Command write, for type 01 a status message (00) will be returned	
4	Process	Cppppppp	c	Process chained
			p	Process number
5	Parameter type	Cttppppp	c	Parameter chained
			t	Parameter type
			p	Parameter number (FBnr.)
6	Value 1		Value for all types. For ‘strings’ this field contains the string length.	
7	Value 2		Value for type ‘integer’, ‘float’ or ‘long’.	
8	Value 3		Value for type ‘float’ or ‘long’.	
9	Value 4		Value for type ‘float’ or ‘long’.	
X	Value x		More value fields follow for type ‘string’ depending on string length. If given string length is zero, the final field should also contain a zero.	
X+1	‘\r’		Carriage Return	
X+2	‘\n’		Line Feed	

3.8 Request parameter

For each requested parameter an index number can be given. The answering node will return this index number with the requested parameter. This can be used to check which parameter is returned when several parameters are requested.

Request

Nr	Byte	Layout	Description	
0	:		start character	
1	Length		Message length	
2	Node		Node address	
3	04		Command read	
4*	Process (return)	Cppppppp	c	Process chained
			p	Process number
5*	Parameter type & index (return)	Cttnnnnn	c	Parameter chained
			t	Parameter type
			n	Parameter index 0…31
6	Process	-ppppppp	-	Not used
			p	Process number
7	Parameter	-ttppppp	-	Not used
			t	Type parameter
			p	Parameter number (FBnr.)
8	String length		For parameter type ‘string’ this field contains the expected string length.	
9	‘\r’		Carriage Return	
10	‘\n’		Line Feed	

Answer of request

Nr	Byte	Layout	Description	
0	:		start character	
1	Length		Message length	
2	Node		Node address	
3	02		Command write	
4*	Process	Cppppppp	c	Process chained
			p	Process number
5*	Parameter type & index	Cttnnnnn	c	Parameter chained
			t	Parameter type
			n	Parameter index 0…31
6	Value 1		Value for all types. For ‘strings’ this field contains the string length.	
7	Value 2		Value for type ‘integer’, ‘float’ or ‘long’.	
8	Value 3		Value for type ‘float’ or ‘long’.	
9	Value 4		Value for type ‘float’ or ‘long’.	
X	Value x		More value fields follow for type ‘string’ depending on string length. If given string length is zero, the final field should also contain a zero.	
X+1	‘\r’		Carriage Return	
X+2	‘\n’		Line Feed	

*The requested module copies these values from the request message directly into the answer message.

3.9 Initialising RS232/FLOW-BUS interface

If you use a RS232/FLOW-BUS interface for communication (without the micro-switch and 2 LED's), note that this module is not part of the (FLOW-BUS) token-ring network, directly at power-up. This means that it is always necessary to re-initialise the module when power has been interrupted!

This is not the case when using an RS232/FLOW-BUS interface with micro-switch, red LED, green LED and RJ45 connector for FLOW-BUS. By means of the switch you may force the interface to find a free address on the FLOW-BUS once. You may skip the initialisation and start directly sending messages.

Also when using digital (Multibus) instruments with RS232 directly on the instrument it is not needed to initialise (give a free node-address to) the instrument on the FLOW-BUS because instrument is not physically connected to the FLOW-BUS, but only uses the same protocol. You may start directly sending your messages to the instrument on either the node-address of the instrument in its memory e.g. node 3 (selective response) or to node-address 128 (always response).

At power-up situation you can communicate with the RS232 interface only at the RS232 side via node 0. To get part of the FLOW-BUS you have to send an init. command, send the network parameters PNA, SNA, NNA, LNA and BM and send a reset command. From this moment the interface is part of the FLOWBUS. Ensure the module gets a free and unique address on the bus, 2 modules on the same address will cause communication problems. When you are sure that there are no more interfaces in the system, simply force the RS232/FLOW-BUS interface to address 1. This address is reserved for an interface.
PC-support software (FLOWB32.DLL) will search for a free address on which the interface will be installed.

Follow the steps below to realise correct initialisation for this interface via RS232:

Initialisation RS232 interface (needed for FLOW-BUS/RS232 interfaces without switch and LEDs only)

Send	Response	Comment
:050001000A49\r\n*		Init instruction for node 0 process 0.
	:04000000XX\r\n	No error.
:050001000101\r\n		PNA = Primary Node Address = 1
	:04000000XX\r\n	No error.
:05000100027F\r\n		SNA = Secondary Node Address = 127
	:04000000XX\r\n	No error.
:050001000302\r\n		NNA = Next Node Address = 2
	:04000000XX\r\n	No error.
:050001000420\r\n		LNA = Last Node Address = 32 (depends on system size)
	:04000000XX\r\n	No error.
:050001000502\r\n		BM = Bus Management = 67 67 = everything automatically (auto arbitration+gap skipping) 3 = auto arbitration 2 = always busmaster 1 = temporary In older systems: when no R/C-modules in system make BM = 2, when R/C-modules in system (already busmasters present) than make BM = 1; otherwise make = 67
	:04000000XX\r\n	No error.
:050001000A52\r\n		Reset instruction for module; from this moment on module will be active on FLOW-BUS at node address = PNA
	:04000000XX\r\n	No error.

- Sometimes it could be necessary to repeat the first instruction. Wait approx. 2 seconds before sending the next command.
- XX means: don't care

Communication can be closed and interface can be disabled from FLOW-BUS token-ring traffic by sending the command below via the RS232 to the interface.

Stop communication RS232 interface

Send	Comment
:050101001101\r\n	close communication instruct. for interface module there will be no aswer (because communication stops) second byte is actual node address for interface (here: 01)

3.10 Examples

3.10.1 Sending setpoint

Sending setpoint 50% to node 3 process 1. Setpoint values should be given in a range from 0 to 32000 so for this example 16000 should be send.

Send parameters to node 3

Nr	Byte	Layout	Description		
0	':'		Start character		
1	06		Length 6		
2	03		Node 3		
3	01		Command write with status response		
4	01	00000001	C	00	Process not chained
			P	01	Process 1
5	21	00100001	C	00	Parameter not chained
			T	20	Parameter type 'integer'
			P	01	Parameter number (FBnr.) 1
6	3E		Setpoint 16000 = 3E80h		
7	80				
8	'\r'		Carriage Return		
9	'\n'		Line Feed		

Answer from node 3

Nr	Byte	Description
0	':'	Start character
1	04	Fixed message length 4.
2	01	Node address 01
3	00	Command status
4	00	Status ok.
5	05	Status ok, value points to end of send message.
6	'\r'	Carriage Return
7	'\n'	Line Feed

3.10.2 Sending chained parameters

Interface sends following parameters to module at node 3:
Process 0: INIT MODE (10), 64 = soft init
Process 1: FLUIDNUMBER(16). 1
Process 1: POLYNOMIAL CONSTANTE A(5), 0.0
Process 1: POLYNOMIAL CONSTANTE B(6), 1.0
Process 1: POLYNOMIAL CONSTANTE C(7), 0.0
Process 1: POLYNOMIAL CONSTANTE D(8), 0.0
Process 0: INIT MODE (10), 82 = reset initmode.

Send parameters to node 3

Nr	Byte	Layout	Description		
0	':'				
1	1D		Length 29		
2	03		Node 3		
3	01		Command write with status response		
4	80	10000000	C	80	Process chained
			P	00	Process 0

5	0A	00001010	C	00	Parameter not chained
			T	00	Parameter type ‘character’
			N	0A	Parameter number (FBnr.)10
6	40	01000000	Parameter value 64 set soft init mode		
7	81	10000001	C	80	Process chained
			P	01	Process 1
8	C5	11000101	C	80	Parameter chained
			T	40	Parameter type ‘float’
			N	05	Parameter number (FBnr.) 5
9	00		Parameter value ‘float’ 0.0		
10	00				
11	00				
12	00				
13	C6	11000110	C	80	Parameter chained
			T	40	Parameter type ‘float’
			N	06	Parameter number (FBnr.) 6
14	3F		Parameter value ‘float’ 1.0		
15	80				
16	00				
17	00				
18	C7	1100111	C	80	Parameter chained
			T	40	Parameter type ‘float’
			N	07	Parameter number (FBnr.) 7
19	00		Parameter value ‘float’ 0.0		
20	00				
21	00				
22	00				
23	C8	11001000	C	80	Parameter chained
			T	40	Parameter type ‘float’
			N	08	Parameter number (FBnr.) 8
24	00		Parameter value ‘float’ 0.0		
25	00				
26	00				
27	00				
28	00	00000000	C	00	Process not chained
			P	00	Process 0
29	0A	00001010	C	00	Parameter not chained
			T	00	Parameter type ‘character’
			N	0A	Parameter number (FBnr.) 10
30	52	01010010	Parameter value 82, reset init mode		
31	‘\r’		Carriage Return		
32	‘\n’		Line Feed		

Answer from node 3

Nr	Byte	Description
0	':'	Start character
1	04	Fixed message length 4.
2	03	Node address
3	00	Command status
4	00	Status ok.
5	1C	Status ok, value points to end of send message.
6	'\r'	Carriage Return
7	'\n'	Line Feed

3.10.3 Request setpoint

Request setpoint from node 3 process 1, type integer.

Nr	Byte	Layout	Description		
0	':'				
1	06		Length 6		
2	03		Node 3		
3	04		Command read		
4	01	00000001	C	00	Process not chained (return)
			P	01	Process 1 (return)
5	21	00100001	C	00	Parameter not chained (return)
			T	20	Parameter type 'integer' (return)
			N	01	Parameter index 1 (return)
6	01	-0000001	P	01	Process 1
7	21	-0100001	T	20	Parameter type 'integer'
			P	01	Parameter number (FBnr.) 1 (setpoint)
8	'\r'				Carriage Return
9	'\n'				Line Feed

Answer by node 3

Nr	Byte	Layout	Description		
0	':'				
1	06		Length 6		
2	03		Node 3		
3	02		Command write		
4	01	00000001	C	00	Process not chained
			P	01	Process 1 (receiving process)
5	21	00100001	C	00	Parameter not chained
			T	20	Parameter type 'integer'
			N	01	Parameter index 1
6	3E		Value 3E80h = 16000 = 50%		
7	80				
8	'\r'		Carriage Return		
9	'\n'		Line Feed		

3.10.4 Request chained parameters

Interface sends a request for the following parameters to module at node 3:
Process 113: SerialNum (3), UserTag (6)
Process 1 : Measure (0), Capacity (13), Capunitstr (31), Fluidname (17)

Request by node 3

Nr	Byte	Layout	Description		
0	':'				
1	1A		Length 26		
2	03		Node 3		
3	04		Command read		
4	F1	11110001	C	80	Process chained (return)
			P	71	Process 113 (return)
5	EC	11101100	C	80	Parameter chained (return)
			T	60	Parameter type ‘string’ (return)
			N	0C	Parameter index 12 (return)
6	71	-1110001	P	71	Process 113
7	63	-1100011	T	60	Parameter type ‘string’
			P	03	Parameter number (FBnr.) 3 – Serial Number
8	14	10000100		14	String length 20
9	6D	01101101	C	00	Parameter not chained (return)
			T	60	Parameter type ‘string’ (return)
			N	0D	Parameter index 13 (return)
10	71	-1110001	P	71	Process 113
11	66	-1100110	T	60	Parameter type ‘string’
			P	06	Parameter number (FBnr.) 6 – Usertag
12	00	00000000			String length 00, length not defined
13	01	00000001	C	00	Parameter not chained (return)
			P	01	Process 1 (return)
14	AE	10101110	C	80	Parameter chained (return)
			T	20	Parameter type ‘integer’ (return)
			N	0E	Parameter index 14 (return)
15	01	-0000001	P	00	Process 1
16	20	-0100000	T	20	Parameter type ‘integer’
			P	00	Parameter number (FBnr.) 0 – Measure
17	CF	11001111	C	80	Process chained (return)
			T	40	Parameter type ‘float’ (return)
			N	0F	Parameter index 15 (return)
18	01	-0000001	P	01	Process 1
19	4D	-1001101	T	40	Parameter type ‘float’
			P	0D	Parameter number (FBnr.) 13 – Capacity
20	F0	11110000	C	80	Parameter chained (return)
			T	60	Parameter type ‘string’ (return)
			N	10	Parameter index 16 (return)
21	01	-0000001	P	01	Process 1
22	7F	-1111111	T	60	Parameter type ‘string’
			P	1F	Parameter number (FBnr.) 31 – Capacity Unit Sting
23	07	00001110		07	String length 7
24	71	01110001	C	00	Parameter not chained (return)
			T	60	Parameter type ‘string’ (return)
			N	11	Parameter index 17 (return)

25	01	-0000001	P	01	Process 1
26	71	01110001	T	60	Parameter type ‘string’
			P	11	Parameter number (FBnr.) 17 – Fluidname
27	0A				String length 10
28	‘\r’				Carriage Return
29	‘\n’				Line Feed

Answer by node 3

Nr	Byte	Layout	Description		
0	':'				
1	41		Number of bytes which do follow: 65 bytes		
2	03		Node 3		
3	02		Command write		
4	F1	11110001	C	80	Process chained
			P	71	Process 113 (recieving process)
5	EC	11101100	C	80	Parameter chained
			T	60	Parameter type ‘string’
			N	0C	Parameter index 12
6	14		Length of the answer 20 Bytes		
7-26	4D 36 32 31 32 33 34 35 41 20 20 20 20 20 20 20 20 20 20 Parameter value converted from hex to ASCII : M6212345A				
27	6D	01101101	C	00	Process not chained
			T	60	Parameter type ‘string’
			N	0D	Parameter index 13
28	00		String length 00, length not defined		
29-36	55 53 45 52 54 41 47 00 Parameter value converted from hex to ASCII, the values do read: USERTAG				
37	01	00000001	C	00	Process not chained
			P	01	Process 1 (receiving process)
38	AE	10101110	C	80	Parameter chained
			T	20	Parameter type ’integer’
			N	0E	Parameter index 14
39	1C		Parameter value is: 1CD8 (hex) Measure Value is: 7384 (dec)		
40	D8				
41	CF	11001111	C	80	Parameter chained
			T	40	Parameter type ‘float’
			N	0F	Parameter index 15
42	3F		Parameter Value: 3F 80 00 00 (IEEE-floating point notation , 32-bit single precision) Parameter value converted from float to decimal , the values do read: 1.0		
43	80				
44	00				
45	00				
46	F0	11110000	C	80	Parameter chained
			T	60	Parameter type ’string
			N	10	Parameter index 16
47	07		Length of the answer 7 Bytes		
48-54	6D 6C 6E 2F 6D 69 6E Parameter value converted from hex to ASCII, the values do read: mln/min				
55	71	01110001	C	00	Parameter not chained
			T	60	Parameter type ’string’
			N	11	Parameter index 17
56	0A		Length of the answer 10 Bytes		
57-66	4E 32 20 20 20 20 20 20 20 20 Parameter value converted from hex to ASCII, the values do read: N2				

3.10.5 Request measure

Request measure from node 3 process 1, type integer.

Nr	Byte	Layout	Description		
0	':'				
1	06		Length 6		
2	03		Node 3		
3	04		Command read		
4	01	00000001	C	00	Process not chained (return)
			P	01	Process 1 (return)
5	21	00100001	C	00	Parameter not chained (return)
			T	20	Parameter type 'integer' (return)
			N	01	Parameter index 1 (return)
6	01	-0000001	P	01	Process 1
7	20	-0100000	T	20	Parameter type 'integer'
			P	00	Parameter number (FBnr.) 0 (measure)
8	'\r'				Carriage Return
9	'\n'				Line Feed

Answer by node 3

Nr	Byte	Layout	Description		
0	':'				
1	06		Length 6		
2	03		Node 3		
3	02		Command write		
4	01	00000001	C	00	Process not chained
			P	01	Process 1 (receiving process)
5	21	00100001	C	00	Parameter not chained
			T	20	Parameter type 'integer'
			N	01	Parameter index 1
6	3E		Value 3E80h = 16000 = 50%		
7	80				
8	'\r'		Carriage Return		
9	'\n'		Line Feed		

3.10.6 Request counter value

Request countervalue (cntrvalue) from node 3 process 104, type float.

Nr	Byte	Layout	Description		
0	':'				
1	06		Length 6		
2	03		Node 3		
3	04		Command read		
4	68	01101000	C	00	Process not chained (return)
			P	68	Process 104 (return)
5	41	01000001	C	00	Parameter not chained (return)
			T	40	Parameter type 'float' (return)
			N	01	Parameter index 1 (return)
6	68	-1101000	P	68	Process 104
7	41	-1000001	T	40	Parameter type 'float'
			P	01	Parameter number (FBnr.) 1 (cntrvalue)
8	'\r'				Carriage Return
9	'\n'				Line Feed

Answer by node 3

Nr	Byte	Layout	Description		
0	':'				
1	08		Length 8		
2	03		Node 3		
3	02		Command write		
4	68	01101000	C	00	Process not chained
			P	68	Process 104 (receiving process)
5	41	01000001	C	00	Parameter not chained
			T	40	Parameter type 'float'
			N	01	Parameter index 1
6	45		Parameter value 'float' = 5023.96 dec.		
7	9C				
8	FF				
9	AE				
10	'\r'		Carriage Return		
11	'\n'		Line Feed		

4 Dual interface operation

When operating a controller (reading measured value and sending setpoint) for proper operation it is important that the controller gets its setpoint from the right source.
Setpoints may come from different sources: analog input, fieldbus interface or RS232 or may be overruled by close valve or open valve (purge) commands.
Therefore it is important to know what is the setpoint source of the controller.
This can be set by means of parameter controlmode (process 1, parameter 12).

In some cases it is possible that the setpoints may come from 2 sources at the same time.
The last send setpoint will be valid and send to the controller.
This is the case in controlmode = 0, when setpoints may come through any fieldbus interface or RS232.

However, there could be situations where control over the instrument seems impossible.
This is the case when the instrument comes into a safe-state e.g. when fieldbus communication is disturbed or disconnected. Valve will be forced to a safe state automatically: closed (NC) or fully open (NO).

In case you want to get control back via RS232 operation, you have to change the controlmode.
When controlmode gets value 18, safe state will be overruled and sending setpoints via RS232 interface will have effect on the controller again.

See also document nr. 9.17.023 for more detailed description about digital instrument parameters and their behaviour.

5 Parameter information

FLOW-BUS is used for parameter value exchange between instruments and operation modules (keyboard or PC-interface).
Parameter information consists of several properties for behaviour within the FLOW-BUS system.
In the ‘parameter properties’ table you will find a list of parameters and their properties.
In the ‘parameter values’ table values are described more detailed if necessary. These list consists mostly of parameters for mode settings.

Property description in ‘parameter properties’ table:

Item	**Description**
Parameter(DDE)	unique parameter number (also used for DDE-communication : P(x))
Name	parameter name (max. 10 characters) used for parameter identification
process	process where parameter is used on FLOW-BUS module used for communication directly through RS232 when filled in the table, this value has to be used (for parameters located in only 1 process) when empty in the table, process has to be determined from the FLOW-BUS system information (for parameters located in more than one process, f.i. setpoint, measure);
FBnr(parameter)	parameter number in process on FLOW-BUS module used for communication directly through RS232
VarType	variable type for information about amount of bytes c : (unsigned) char type; 1 byte; value 0..255 i : (unsigned) integer type; 2 bytes; value 0..65535 f : float type, 4 bytes, value +-1.18E-38..+-3.39E+38 (IEEE-floating point notation) l : (unsigned) long type, 4 bytes, value 0..4294967295 data types > 1 byte are MSB first.
VarLength	variable length to indicate length of string of chars used in combination with VarType c for transportation of strings through FLOW-BUS: value 0..65535 VarLength indicates the amount of bytes for a parameter type -2: indicates that a string is zero-terminated, not defined for length X : indicates a string with a length of X bytes (characters) 0 : means no info required.
Min	minimum value of parameter allowed when parameter is read/written via RS232, the value will be checked on this limit (error when out of limit)
Max	maximum value of parameter allowed when parameter is read/written via RS232, the value will be checked on this limit (error when out of limit)
Read	indication if parameter is allowed to be read via FLOW-BUS
Write	indication if parameter is allowed to be written via FLOW-BUS
Poll	indication if parameter should be polled continuously by RS232 application in order to keep (changing) parameter information up to date
Advanced	indication if parameter is for advanced users only these are mainly parameters for maintenance/service
Secured	indication if parameter is secured for use through FLOW-BUS reading this parameter is possible, but changing it needs special handling
High security	indication if parameter is highly secured (only few parameters) reading this parameter is possible, but changing it needs special handling
Description	short description about meaning of parameter or what it is used for

Parameter acceptance:
Changing parameter values is possible when a parameter is not read-only and not secured. The range and type of parameters are described in the tables. When parameter values are out of range they will be either 'clipped' on the nearest value allowed or you will get an error message: 'parameter value error'.

(DDE)Parameter numbers:
All parameter information is referenced to the parameter number. This is a unique number for a parameter to avoid redundancy. These numbers are needed for DDE communication only.

For communication with FLOW-BUS through other ways than DDE: directly via RS232 ASCII-strings or via C-libraries (DOS or Windows), use the parameter numbers for the FLOW-BUS modules (in column FBnr of table Parameter properties). Now you will always have to know the node-address of the instrument on the FLOW-BUS, the process number on the instrument and the parameter number on the instrument.

Process nr could be read from the table or has to be determined, when nothing is filled-in. In most cases process number will be = 1.
Node-address should be determined also. This is the node-address of the instrument on the FLOW-BUS. Newer RS232 protocols on multibus instruments accept node = 128. When sending messages to this node address, the message will be always accepted, unregarding the node-address of the instrument on the bus.

NOTE:
It is important to know that not all parameters are available on all FLOW-BUS/Multibus devices.
For more details about parameters and their use see also document nr. 9.17.023 for description of digital instruments.
If you have the program FLOWDDE, you can also get an overview of which parameters are available on which devices.
In other cases ask your local sales representative or send an e-mail to help.flowbus@bronkhorst.com.

Appendix 1 and 2 will give information about parameters, their properties and their possible values.

6 Troubleshooting

• RS232 communication problems	Check cables. Make sure correct cables are used for specific purpose. Check address of interface (slave). Sending messages to node 128 will mostly be accepted by the interface. Try to reset the instrument and/or restart your PC/PLC. Make sure your messages are assembled according to FLOW-BUS protocol description. Make sure the parameter values you try to read/write are available and in the correct ranges (check tables). Controller doesn't respond on setpoints: - Check control mode, when 0 and other fieldbus gives error: safe state will be entered, resulting in safe setpoint. Can be overruled by making controlmode = 18 (RS232 only operation) - Alarm or counter module in instrument forces setpoint to alarm setpoint. Reset alarm or counter and proceed. - Setpoint slope could have very high value. New setpoints will be reached when this slope time has been elapsed. Make setpoint slope smaller. - Control mode could have other value than 0 or 18. Check function when value is different. - If measure doesn't change check forward pressure and piping (evt. shut-off valves). - Make sure setpoints are within allowed range: 0...32000 (= 0...100%). - Make sure setpoints are send to proper instrument and process (mostly = 1) and parameter (FBnr for setpoint = 1), and type of data is correct (short integer = 2 bytes MSB first) Contact local sales representative or service department.
• Other (FLOW-BUS) problems	Contact Bronkhorst High-Tech local sales representative or send e-mail describing your problem to: **help.flowbus@bronkhorst com**

APPENDIX 1

Parameter properties table

Parameter properties table

Bronkhorst® HIGH-TECH

Parameter number (DDE)	Parameter name	Group 0	Group 1	Group 2	Process number	FB nr (par)	Var Type	Var Length	Min value	Max value	Read	Write	Poll	Secured	Highly Secured	Default Value	Description
1	identstrng	13			0	0	c	-2			Yes	Yes	No	No	No	7SN999999	identnr.+softwareversion[+serialnr.]
2	pna	1			0	1	c		0	128	Yes	Yes	No	Yes	Yes	0	primary node address: network parameter FLOW-BUS
3	sna	1			0	2	c		0	128	Yes	Yes	No	Yes	Yes	0	secundary node address: network parameter FLOW-BUS
4	nna	1			0	3	c		0	128	Yes	Yes	No	No	No	1	next node address: network parameter FLOW-BUS
5	lna	1			0	4	c		0	128	Yes	Yes	No	No	No	32	last node address: network parameter FLOW-BUS
6	arbitrage	1			0	5	c		0	255	Yes	Yes	No	Yes	Yes	67	FLOW-BUS arbitrage setting and/or automatic optimization
7	initreset	12			0	10	c		0	255	Yes	Yes	No	No	No		init and reset security key commands for network/parameter settings
8	measure	2				0	i		-23593	41942	Yes	No	Yes	No	No	0	measured value (100% = 32000)
9	setpoint	2	18			1	i		0	32767	Yes	Yes	Yes	No	No	0	setpoint: wanted value (100% = 32000)
10	setpslope	18				2	i		0	30000	Yes	Yes	No	No	No	0	setpoint ramp signal 0..100 % in up to slope x 0.1 sec.
11	analoginp	2	18			3	i		-23593	41942	Yes	No	Yes	No	No	0	analog input signal, normally used for ext. setp. (100% = 32000)
12	cntrlmode	18				4	c		0	255	Yes	Yes	No	No	No	0	control mode selection for instrument or module
13	polycnst A	3				5	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0.0	polynomial constant A (offset)
14	polycnst B	3				6	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	1.0	polynomial constant B (span]
15	polycnst C	3				7	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0.0	polynomial constant C
16	polycnst D	3				8	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0.0	polynomial constant D
17	polycnst E	3				9	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0.0	polynomial constant E (offset) for setpoint or power value
18	polycnst F	3				10	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	1.0	polynomial constant F (span) for setpoint or power value
19	polycnst G	3				11	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0.0	polynomial constant G for setpoint or power value
20	polycnst H	3				12	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0.0	polynomial constant H for setpoint or power value
21	capacity	3	19			13	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	1.0	maximum value at 100% in sensor base units
22	sensortype	3				14	c		0	255	Yes	Yes	No	Yes	No	3	sensor type information for actual reading and sensor/controller indication
23	capunit	3	19			15	c		0	255	Yes	Yes	No	Yes	No	0	pointer to selected actual readout unit (index for list of readout units]
24	fluidnr	3				16	c		0	8	Yes	Yes	No	No	No	0	fluid number: pointer to polynome, name and cap.
25	fluidname	3				17	c	10			Yes	Yes	No	Yes	No	AIR	name of fluid
26	claimnode	12				18	c		0	128	Yes	Yes	No	Yes	No	0	node address of module with operation rights
27	modify	12				19	c		0	255	Yes	Yes	No	No	No	0	contains number(s) of changed par (0xXX par nr, 0xFF more than one par cha
28	alarminfo	4				20	c		0	255	Yes	No	Yes	No	No	0	status information of several alarms/errors in the instrument
29	chanamount	17			0	12	c		1	120	Yes	Yes	No	No	No	32	amount of channels which can be operated
30	firstchan	17			0	13	c		1	120	Yes	Yes	No	No	No	1	first channel that can be operated
31	lastchan	17			0	14	c		1	120	Yes	Yes	No	No	No	32	last channel that can be operated
32	hostcontrl	5			9	1	c		0	1	Yes	Yes	No	No	No	0	operation by HOST computer enable flag
33	alrmmsgTA	5			10	0	c	16			Yes	No	Yes	No	No		alarm message string with unit type information
34	alrmmsgnr	5			10	1	c	16			Yes	No	Yes	No	No		alarm message string with unit number information
35	relstatus	5			10	2	c	8			Yes	No	No	No	No		status of relays/potential free contacts ('0' = not activated, '1' = activated)
36	actualval	5				0	f		0	3.4028E+38	Yes	No	Yes	No	No	0	actual value of counter
37	signinpsel	5				1	c	8			Yes	Yes	No	No	No		signal input selection (' '=no value,'+'=pos value,'-'=neg value input)
38	resinpsel	5				2	c	8			Yes	Yes	No	No	No		external reset input enable/disable ('E'=enable,' '=disable)
39	limit	5				3	f		0	3.4028E+38	Yes	Yes	No	No	No		limit/batch for counter in sensor standard units
40	delaytime	5				4	c	8	0	99235959	Yes	Yes	No	No	No	00000000	delay time string in days,hours,minutes,seconds
41	duratntime	5				5	c	8	0	99235959	Yes	Yes	No	No	No	00000000	duration time string in days,hours,minutes,seconds
42	vlvoutset	5				6	c	8			Yes	Yes	No	No	No	00000000	valve output setting ('0'=do nothing, '1'=close valve)
43	reloutset	5				7	c	8			Yes	Yes	No	No	No	LLLLLLLL	relay output setting ('L'=low, 'H'=high, 'P'=pulse (1 sec.))
44	opermodeTA	5				8	c		0	9	Yes	Yes	No	No	No	0	operation mode of T/A module
45	readunit	5				9	c	7			Yes	No	No	No	No	ln/min	readout unit string
46	readfact	5				10	f		1E-10	1E+10	Yes	No	No	No	No	1	readout factor matching readout unit string
47	resetunit	5				12	c		0	1	No	Yes	No	No	No		reset unit command (1=reset T/A unit)
48	TdValveDn	6				9	f		0	3.4028E+38	Yes	Yes	No	Yes	No	0.1	valve output differentiation time constant downwards
49	TdValveUp	6				10	f		0	3.4028E+38	Yes	Yes	No	Yes	No	0.1	valve output differentiation time constant upwards
50	TdSensorDn	6				11	f		0	3.4028E+38	Yes	Yes	No	Yes	No	5.8	sensor signal differentiation time constant downwards
51	TdSensorUp	6				12	f		0	3.4028E+38	Yes	Yes	No	Yes	No	5.6	sensor signal differentiation time constant upwards
52	CycleTime	6			114	12	c		1	255	Yes	Yes	No	Yes	No	6	cycle time * 10 msec. main loop signal processing
53	AnalogMode	10			115	3	c		0	255	Yes	Yes	No	Yes	No	0	analog mode selection for analog operation
54	VrefOutput	10			116	6	i		0	65535	Yes	Yes	No	Yes	No		reference voltage output signal for analog operation
55	ValveOut	8			114	1	l		0	16777215	Yes	Yes	Yes	No	No	0	valve output signal (24-bit number in range 0…14.3Vdc/0…23.3Vdc)

Parameter number (DDE)	Parameter name	Group 0	Group 1	Group 2	Process number	FB nr (par)	Var Type	Var Length	Min value	Max value	Read	Write	Poll	Secured	Highly Secured	Default Value	Description
56	DynDispFct	6			117	1	f		0	1	Yes	Yes	No	Yes	No	0,001	dynamic display factor for display filter (0=max, 1=min goes with par 57)
57	StaDispFct	6			117	2	f		0	1	Yes	Yes	No	Yes	No	0,000001	static display factor for display filter (0=max, 1=min goes with par 56)
58	CalMode	7			115	1	c		0	255	Yes	Yes	No	Yes	No	0	calibration mode selection (not active until cntrlmode has been set to value 9)
59	ValveOffst	8			116	7	i		-32767	65535	Yes	Yes	No	Yes	No	61000	valve offset: amount of DAC steps within 1 potmeter step
60	Monitor	2			115	2	c		0	255	Yes	Yes	No	Yes	No	7	monitor: output signal (measure) selection for bus and analog output
61	AlarmReg1	4			114	2	c	8			Yes	Yes	No	Yes	No		alarm register containing warning flags
62	AlarmReg2	4			114	3	c	8			Yes	Yes	No	Yes	No		alarm register containing critical error flags
63	CalRegZS1	9			116	1	l		0	16777215	Yes	Yes	No	Yes	No	210A7D	calibration register zero scale input 1 ADC
64	CalRegFS1	9			116	2	l		0	16777215	Yes	Yes	No	Yes	No	52A513	calibration register full scale input 1 ADC
65	CalRegZS2	9			116	3	l		0	16777215	Yes	Yes	No	Yes	No	210A7D	calibration register zero scale input 2 ADC
66	CalRegFS2	9			116	4	l		0	16777215	Yes	Yes	No	Yes	No	52A513	calibration register full scale input 2 ADC
67	ADCcntrReg	9			114	4	l		0	4294967295	Yes	Yes	No	Yes	No	18904E	ADC control register
68	BridgePotm	9			116	5	c		0	255	Yes	Yes	No	Yes	No	0	sensor bridge zero potmeter setting
69	AlarmEnble	4			115	4	c		0	255	Yes	Yes	No	Yes	No	1	broadcast alarm messsage enable flag
70	TestMode	4			115	5	c		0	255	Yes	Yes	No	Yes	No	0	test mode selection (not active until cntrlmode has been set to value 5)
71	ChanSelect	9			115	6	c		1	32	Yes	Yes	No	Yes	No	1	channel selection ADC
72	ContrResp	8			114	5	c		0	255	Yes	Yes	No	Yes	No	0	controller response for normal steps (128=normal, <128=slower, >128=faster)
73	ErrInFilCo	6			117	3	f		0	1	Yes	Yes	No	Yes	No	1.0	analog input filter constant (0=max, 1=min)
74	ExpSmooCo	6			117	4	f		0	1	Yes	Yes	No	Yes	No	1.0	sensor input filter constant (0=max, 1=min)
75	AnOutCorZS	10				21	i		-32767	65535	Yes	Yes	No	Yes	No	32767	analog output correction factor zero scale (meas outp DSCM-A 0=0 other 3276
76	AnOutCorFS	10				22	i		0	65535	Yes	Yes	No	Yes	No	2000	analog output correction factor full scale (meas outp 2000 = 1 * multiplication)
77	AnInpCorZS	10				23	i		-32767	65535	Yes	Yes	No	Yes	No	32767	analog input correction factor zero scale (ext setp DSCM-A 0=0 other 32767=0
78	AnInpCorFS	10				24	i		0	65535	Yes	Yes	No	Yes	No	2000	analog input correction factor full scale (ext setp 2000 = 1 * multiplication)
79	TuningMode	7			115	7	c		0	255	Yes	Yes	No	Yes	No	0	(auto)tuning mode selection (not active until cntrlmode has been set to value 6
80	DefVlvType	8			114	6	c		0	255	Yes	Yes	No	Yes	No	0	valve type (needed for controlling behaviour)
81	GlobModify	12			0	19	c		0	255	Yes	Yes	No	No	No	0	contains number(s) of changed processes for indirect polling (0xXX / 0xFF)
82	SpanCorr	8			114	7	f		0	1	Yes	Yes	No	Yes	No	0.1	correction factor valve curve ratio high/low area
83	VlvCrvStps	8			114	8	c	-2			Yes	Yes	No	Yes	No	20,80	Valve curve correction for controller (max. factor*0.1, flow where factor = 1)
84	MemShipNor	8			114	9	c	-2			Yes	Yes	No	Yes	No	L0,5000,10,5000	array with memberships for normal Fuzzy controller
85	MemShipOp	8			114	10	c	-2			Yes	Yes	No	Yes	No	L0000,3750,200	array with memberships for 0-open Fuzzy controller
86	IOStatus	12	20		114	11	c		0	255	Yes	Yes	No	Yes	No	4	IO status byte for jumper settings and LED signal modes
87	FuzzStNeNo	8			114	13	c	-2			Yes	Yes	No	Yes	No	-30000,-500,-50	array with neg nor output steps for Fuzzy contr.
88	FuzzStPoNo	8			114	14	c	-2			Yes	Yes	No	Yes	No	50,500,25000	array with pos nor output steps for Fuzzy contr.
89	FuzzStOpen	8			114	15	c	-2			Yes	Yes	No	Yes	No	90,180,12000	array with open at 0 output steps for Fuzzy contr.
90	DeviceType	13			113	1	c	6			Yes	No	No	No	No	DMFC	(FLOW-BUS) device type information string
91	ModelNum	13			113	2	c	-2			Yes	Yes	No	Yes	No	F201C-FA	model number information string
92	SerialNum	13			113	3	c	-2			Yes	Yes	No	Yes	Yes	SN999999A	serial number information string (to be changed by Bronkhorst HT only)
93	MfrConfig	11			113	4	c	-2			Yes	Yes	No	Yes	No	STANDARD	manufacturing configuration information string
94	BHT1	14			118	1	c	-2			Yes	Yes	No	Yes	Yes	01,01,95	special BHT parameter (to be changed by Bronkhorst HT only)
95	BHT2	14			118	2	i		0	65535	Yes	No	No	No	No	0	special BHT parameter
96	BHT3	14			118	3	l		-3000000000	3000000000	Yes	No	No	No	No	0	special BHT parameter
97	BHT4	14			118	4	i		0	65535	Yes	No	No	No	No	0	special BHT parameter
98	BHT5	14			118	5	c		0	255	Yes	No	No	No	No	0	special BHT parameter
99	BHT6	14			118	6	c		0	255	Yes	Yes	No	No	No	0	special BHT parameter
100	BHT7	14			118	7	c		0	255	Yes	No	No	No	No	0	special BHT parameter
101	BHT8	14			118	8	c		0	255	Yes	No	No	No	No	0	special BHT parameter
102	BHT9	14			118	9	l		-3000000000	3000000000	Yes	No	No	No	No	0	special BHT parameter
103	BHT10	14			118	10	c		0	1	No	Yes	No	Yes	Yes	0	special BHT parameter (to be changed by Bronkhorst HT only)
104	PulseHight	8			114	16	c		0	255	Yes	Yes	No	Yes	No	128	height of open at zero pulse train for valve
105	Version	13	20		113	5	c	5			Yes	No	No	No	No	VX.XX	revision number of firmware
106	PressSensr	20			115	9	c		0	255	Yes	Yes	No	Yes	No	0	type of pressure sensor
107	BaroPress	20			116	8	f		0	1200	Yes	Yes	No	No	No	1013.25	mbar atmospheric (central) barometer pressure
108	AnIn1CorZS	10				25	i		-32767	65535	Yes	Yes	No	Yes	No	32767	analog sensor signal input corr. factor zero scale (DSCM-A 0=0 other 32767=0
109	AnIn1CorFS	10				26	i		0	65535	Yes	Yes	No	Yes	No	2000	analog sensor signal input correction factor full scale (2000=1*multiplication)
110	AnIn2CorZS	10				27	i		-32767	65535	Yes	Yes	No	Yes	No	32767	analog Vref input correction factor zero scale (DSCM-A 0=0 other 32767=0)
111	AnIn2CorFS	10				28	i		0	65535	Yes	Yes	No	Yes	No	2000	analog Vref input correction factor full scale (2000=1*multiplication)
112	AnOu1CorZ	10				29	i		-32767	65535	Yes	Yes	No	Yes	No	32767	analog setpoint output correction factor zero scale (DSCM-A 0=0 other 32767=
113	AnOu1CorF	10				30	i		0	65535	Yes	Yes	No	Yes	No	2000	analog setpoint output correction factor full scale (2000=1*multiplication)
114	Reset	12			115	8	c		0	255	No	Yes	No	No	No	0	reset facilities (program/alarm/batchcounter)
115	UserTag	11			113	6	c	-2			Yes	Yes	No	No	No	USERTAG	user definable alias string
116	AlrmMaxLim	15			97	1	i		0	32767	Yes	Yes	No	Yes	No	0	maximum limit for sensor signal to trigger alarm situation

Parameter number (DDE)	Parameter name	Group 0	Group 1	Group 2	Process number	FB nr (par)	Var Type	Var Length	Min value	Max value	Read	Write	Poll	Secured	Highly Secured	Default Value	Description
117	AlrmMinLim	15			97	2	i		0	32767	Yes	Yes	No	Yes	No	0	minimum limit for sensor signal to trigger alarm situation
118	AlrmMode	15			97	3	c		0	255	Yes	Yes	No	Yes	No	0	alarm mode
119	AlrmOutMod	15			97	4	c		0	255	Yes	Yes	No	Yes	No	0	alarm relais activity mode during alarm situation
120	AlrmStpMod	15			97	5	c		0	1	Yes	Yes	No	Yes	No	0	setpoint change enable during alarm situation
121	AlrmNwSetp	15			97	6	i		0	32767	Yes	Yes	No	Yes	No	0	new/safe setpoint during alarm situation (until reset)
122	CntrValue	16			104	1	f		0	9999999.99	Yes	Yes	Yes	Yes	No	0	actual counter value
123	CntrUnit	16			104	2	c		0	31	Yes	Yes	No	Yes	No	0	counter unit
124	CntrLimit	16			104	3	f		0	10000000	Yes	Yes	No	Yes	No	0	counter limit/batch
125	CntrOutMod	16			104	4	c		0	255	Yes	Yes	No	Yes	No	0	counter relais activity mode when limit/batch has been reached
126	CntrStpMod	16			104	5	c		0	1	Yes	Yes	No	Yes	No	0	setpoint change enable during counter limit/batch situation (until reset)
127	CntrNwSetp	16			104	6	i		0	32767	Yes	Yes	No	Yes	No	0	new/safe setpoint at counter limit/batch situation (until reset) (normally = 0%)
128	CntrUntstr	16			104	7	c	4			Yes	No	No	No	No	In	readout string at counter (informative)
129	capunitstr	3	19			31	c	7			Yes	Yes	No	Yes	No	In/min	readout string at capunit (informative only for older devices)
130	CntrMode	16			104	8	c		0	255	Yes	Yes	No	Yes	No	0	counter mode
131	HwRev	13			113	7	c	1			Yes	No	No	No	No	VX.XX	minimum required hardware revision level for firmware version
132	RCreadfact	17				1	f		1E-10	1E+10	Yes	No	No	No	No	1.0	readout factor for direct reading (changes with readunit: local on module, R.O.)
133	channumber	17				2	c		1	120	Yes	Yes	No	No	No	1	channel number for operation
134	masterchan	17				3	c		0	120	Yes	Yes	No	No	No	0	master channel for master-slave operation
135	RCslavefct	17				4	i		0	32000	Yes	Yes	No	No	No	32000	RC slave factor
136	inputnode	17				5	c		0	128	Yes	Yes	No	Yes	No	3	physical node address for channel number
137	inputproc	17				6	c		0	128	Yes	Yes	No	Yes	No	1	physical process for channel number
138	RCreadunit	17				7	c	7			Yes	No	No	No	No	ln/min	readout unit for direct reading (local variable on module: read only)
139	SlaveFact%	18			33	1	f		0	500	Yes	Yes	No	No	No	100.0	slave factor for master slave control (setp = master output * slave factor)
140	VrefInput	18			33	2	i		0	65535	Yes	No	Yes	No	No	0	reference voltage input for setpoint signal
141	RespStable	8			114	17	c		0	255	Yes	Yes	No	Yes	No	0	controller response when controller is stable: |measure-setpoint| < 2%
142	temperatur	19	13		33	7	f		-250	500	Yes	Yes	Yes	No	No	20	absolute temperature in degrees Celsius
143	pressure	19	13		33	8	f		-3.4028E+38	3.4028E+38	Yes	Yes	Yes	No	No	1013.25	absolute pressure in mbar
144	time	19			33	9	f		0	3.4028E+38	Yes	No	Yes	No	No	0	time in milliseconds
145	calvolume	19			33	10	f		0	3.4028E+38	Yes	Yes	No	Yes	No	50	calibrated volume in litres
146	sensornr	19				16	c		0	4	Yes	Yes	Yes	No	No	0	pointer to sensor number in calibration tube (FPP)
147	rangeselct	20	19		115	10	c		0	99	Yes	Yes	Yes	No	No	0	Piston Prover operation mode (write) and status information (read back)
148	TimeOut	20				2	i		0	30000	Yes	Yes	No	Yes	No	0	maximum admitted duration time for specific procedure (in 100 ms)
149	frequency	21			33	9	f		0	100000	Yes	No	Yes	No	No	0	frequency in Hz
150	imp/m3	20			33	10	f		0	3.4028E+38	Yes	Yes	No	Yes	No	42773.4	For FRM and FTM imp/m3 and for FCM imp/kg
151	RefVolFlow	19			33	5	f		0	3.4028E+38	Yes	No	No	No	No	0	volume flow referenced to normal conditions i.e. 0 °C, 1013.25 hPa(a) in ln/min
152	volumeflow	19			33	6	f		-3.4028E+38	3.4028E+38	Yes	No	No	No	No	0	volume flow at actual conditions in l/min
153	delta-p	19			33	11	f		-100000	100000	Yes	No	No	No	No	0	relative pressure between atmosphere and sensor position
154	scalefact	21			33	13	i		1	10000	Yes	No	No	No	No	1	scaling factor (multiplication) for readout on display (for optimal resolution)
155	sensorname	19				17	c	10			Yes	Yes	No	Yes	No	SENSOR0	label with information about stopsensor
156	RstAlarmEn	15			97	9	c		0	15	Yes	Yes	No	Yes	No	15	enable reset of alarm by: keyboard, external signal, FLOW-BUS, automatic
157	RstCountEn	16			104	9	c		0	15	Yes	Yes	No	Yes	No	7	enable reset of counter by: keyboard, external signal, FLOW-BUS, automatic
158	MasterNode	18			33	14	c		1	128	Yes	Yes	No	No	No	3	node number of master instrument output signal for a slave
159	MasterProc	18			33	15	c		1	128	Yes	Yes	No	No	No	1	process number of master instrument output signal for a slave
160	InstrNode	18			33	16	c		1	128	Yes	Yes	No	Yes	No	3	node number of instrument to be operated by another module (keyboard/displa
161	InstrProc	18			33	17	c		1	128	Yes	Yes	No	Yes	No	1	process number of instrument to be operated by another module (keyboard/dis
162	RangeMin	3			33	18	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0.0	minimum value at 0% for special user readout unit
163	RangeMax	3			33	20	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	100.0	Maximum value at 100% for special user readout unit
164	Relay/TTL	12			115	11	c		0	255	Yes	Yes	No	Yes	No	0	Relay/TTL output setting (disabled when used by alarm or counter)
165	RespOpen0	8			114	18	c		0	255	Yes	Yes	No	Yes	No	0	Controller response when valve opens from zero
166	ContrType	8			114	20	c		0	255	Yes	Yes	No	Yes	No	1	Controller settings for special purpose
167	PIDKp	8	3		114	21	f		0	3.4028E+38	Yes	Yes	No	Yes	No	10	PID factor Kp
168	PIDTi	8			114	22	f		0	3.4028E+38	Yes	Yes	No	Yes	No	0.05	PID factor Ti
169	PIDTd	8			114	23	f		0	3.4028E+38	Yes	Yes	No	Yes	No	0	PID factor Td
170	Density	3			33	21	f		0	3.4028E+38	Yes	Yes	No	Yes	No	1.293	Density of selected fluid in kg/m3
171	CalCertNr	13	3		113	8	c	-2			Yes	Yes	No	Yes	Yes		Number of calibration certificate (last basic calibration)
172	CalDate	13	3		113	9	c	8			Yes	Yes	No	Yes	Yes	19991231	Date of last (basic) calibration
173	ServiceNr	13			113	10	c	15			Yes	Yes	No	Yes	Yes	00000000	Servicenumber for repair/rebuilding/recalibration
174	ServDate	13			113	11	c	8			Yes	Yes	No	Yes	Yes	19991231	Date of last service action
175	IdentNr	13			113	12	c		0	255	Yes	Yes	No	Yes	Yes	7	Identification number (type) of instrument/device
176	BHT11	14			118	11	c		0	255	No	Yes	No	Yes	Yes	0	special BHT parameter (to be changed by Bronkhorst HT only)
177	PowerMode	12			115	12	c		0	50	Yes	Yes	No	Yes	No	0	power supply indication in Vdc

Parameter number (DDE)	Parameter name	Group 0	Group 1	Group 2	Process number	FB nr (par)	Var Type	Var Length	Min value	Max value	Read	Write	Poll	Secured	Highly Secured	Default Value	Description
178	Pupstream	13	3		113	13	f		-100000	100000	Yes	Yes	No	Yes	No	3	upstream pressure of fluid in bara (for first fluidnr only)
179	Pdownstrm	13	3		113	14	f		-100000	100000	Yes	Yes	No	Yes	No	1	downstream pressure of fluid in bara (for first fluidnr only)
180	Orifice	13			113	15	f		0	1000	Yes	Yes	No	Yes	No	1	orifice diameter in mm
181	FluidTemp	13	3		113	16	f		-273.15	3.4028E+38	Yes	Yes	No	Yes	No	20	temperature of fluid through instrument (for first fluidnr only)
182	AlrmDelay	15			97	7	c		0	255	Yes	Yes	No	Yes	No	3	time alarm and reset action will be delayed when alarm limit has been exceede
183	capacity0%	3			33	22	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0	capacity of instrument at zero 0% in sensor base units (mostly equal to zero)
184	NumOfChan	12			0	18	c		0	120	Yes	No	No	No	No	1	number of instrument channels available for this device
185	DeviceFunc	12			0	20	c		0	255	Yes	No	No	No	No	5	function of device
186	ScanChan	4			123	1	c		1	255	Yes	Yes	No	No	No	1	Channel number to scan with real time information (to be set once)
187	ScanPar	4			123	3	c		0	255	Yes	Yes	No	No	No	8	Parameter number to scan with real time information (to be set once)
188	ScanTime	4			123	4	i		0	65535	Yes	Yes	No	No	No	50	Scan interval time in msec between two samples (to be set once)
189	ScanData	22	4		123	10	c	-2			Yes	No	No	No	No		Scanned data with time label (can be readout event by event)
190	ValveOpen	8			114	24	f		0	24	Yes	Yes	No	Yes	No	0.04	First-step offset current/voltage for valve when opening from 0%
191	NrOfRuns	20			115	13	c		0	255	Yes	Yes	No	No	No	1	Amount of runs of a piston prover (0 = stability check)
192	MinProTime	20			115	14	c		0	255	Yes	Yes	No	No	No	10	Minimum process time of a piston prover in 0.1 seconds
193	LeakRate	20			116	9	f		0	1	Yes	Yes	No	Yes	No	0.0001	Leak rate piston prover
194	ModeInfReq	12			115	15	c	4			Yes	Yes	No	Yes	No		Sets instr. in info mode for 1 read-cycle to check available parameter options
195	ModeInfOpt	12			115	16	c	255			Yes	No	No	No	No		Gives info about possible values of a mode in an array as result of ModeInfo re
196	ModeInfDes	12			115	17	c	255			Yes	No	No	No	No		Gives description about one of the mode options
197	CalType	20			115	18	c		0	255	Yes	Yes	No	Yes	No	0	Enables/disables options for calibration device (8 bits for 8 options)
198	MassFlow	20			33	4	f		-3.4028E+38	3.4028E+38	Yes	No	Yes	No	No	0	Real mass flow in kg/min
199	BusAddress	23			125	10	c		0	255	Yes	Yes	No	Yes	No	2	Station address for actual fieldbus system other than FLOW-BUS
200	InterfConf	23			125	3	c		0	3	Yes	Yes	No	No	Yes	1	Configuration setting for interface to other bus-systems
201	Baudrate	23			125	9	l		0	1E+10	Yes	Yes	No	Yes	No	12000000	Baudrate for actual fieldbus system other than FLOW-BUS
202	BusDiagnos	23			125	20	c	-2			Yes	No	No	No	No		Bus diagnose string for actual fieldbus system other than FLOW-BUS
203	NrOfVanes	20			115	22	c		0	255	Yes	Yes	No	Yes	No	10	Number of vanes for use in a rotor meter
204	Fieldbus	23			125	21	c	-2			Yes	No	No	No	No	FLOW-BUS	Fieldbus for which instrument has been equiped
205	fMeasure	2			33	0	f		-3.4028E+38	3.4028E+38	Yes	No	No	No	No	0	measured value for direct reading (in capunits, max.= capacity)
206	fSetpoint	2	18		33	3	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	No	No	0	setpoint: wanted value for direct reading (in capunits, max.= capacity)
207	Mass	20			33	23	f		-3.4028E+38	3.4028E+38	Yes	No	Yes	No	No	0	Mass in g
208	Mstatus	4			119	1	c	3			Yes	No	No	No	No		Manufacturer Status register (1 byte diag code + 2 byte diag bits)
209	Mwarning	4			119	2	c	3			Yes	No	No	No	No		Manufacturer Warning register (1 byte diag code + 2 byte diag bits)
210	Merror	4			119	3	c	3			Yes	No	No	No	No		Manufacturer Error register (1 byte diag code + 2 byte diag bits)
211	DiagHist	4			119	4	c	-2			Yes	Yes	No	No	No		Diagnostic history string (contains history of diag codes)
212	DiagMode	4			119	5	c		0	255	Yes	Yes	No	Yes	No	0	Diagnostic mode (0 = diagnostics off, 1 = diagnostics on)
213	MStatEnabl	4			119	6	c		0	255	No	Yes	No	No	No	0	Manufacturer Status enable (0-127 or 254 = disable all, 255 = enable all)
214	AnOutZA	10			116	21	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0	Analog measure output, zero adjust
215	AnOutSA	10			116	22	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	1	Analog measure output, span adjust
216	AnInZA	10			116	23	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0	Analog setpoint input, zero adjust
217	AnInSA	10			116	24	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	1	Analog setpoint input, span adjust
218	SensInZA	10			116	25	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0	Sensor input, zero adjust
219	SensInSA	10			116	26	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	1	Sensor input, span adjust
220	TempInZA	10			116	27	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0	Sensor temperature input, zero adjust
221	TempInSA	10			116	28	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	1	Sensor temperature input, span adjust
222	ExpSmooAd	6			117	5	f		0	1	Yes	Yes	No	Yes	No	1.0	Sensor input filter adapt setting
223	SlopeSetp	18			33	24	i		0	32000	Yes	Yes	No	Yes	No	32000	Slope setpoint step. Setpoint step for the given slopetime
224	FilterLen	6			117	6	i		0	255	Yes	Yes	No	Yes	No	1	Number of samples for Average filter
225	fAccuracy	2			33	25	f		-3.4028E+38	3.4028E+38	Yes	No	No	No	No	0	Actual accuracy in current unit
226	LookI	3			33	26	c		0	20	Yes	Yes	No	No	No	0	Lookup table for linearisation index (x and y direction)
227	LookX	3			33	27	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0	Lookup table for linearisation x
228	LookY	3			33	28	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0	Lookup table for linearisation y
229	LookTempI	3			33	29	c		0	1	Yes	Yes	No	No	No	0	Lookup table for linearisation at certain temperature index (z direction)
230	LookTemp	3			33	30	f		-273.15	3.4028E+38	Yes	Yes	No	Yes	No	0	Lookup table for linearisation at certain temperature (z)
231	ValveMax	8			114	25	f		0	24	Yes	Yes	No	Yes	No	0.2	Maximum current/voltage for valve
232	ValveMode	8			114	26	c		0	255	Yes	Yes	No	Yes	No	1	Valve output mode selection (0 = voltage, 1 = current)
233	VlvOpenCor	8			114	27	f		0	1.5	Yes	Yes	No	Yes	No	0.96	Valve open current/voltage correction (example: 0.96, Open = ValveOpen * 0.9
234	VlvZeroHld	8			114	28	f		0	1	Yes	Yes	No	Yes	No	0	Valve hold current/voltage at %0 setp (example: 0.8, Hold = ValveOpen * 0.8)
235	ValveSlope	8			114	29	f		0	50	Yes	Yes	No	Yes	No	0.009	Valve slope time (Seconds)
236	IFIData	23			0	21	c	-2			Yes	Yes	No	No	No	0	IFI data dump protocol communication string
237	RangeUsed	20			115	20	c	-2	0	99	Yes	No	Yes	No	No	0	Piston Prover information about used sensors
238	FldSetProp	3			33	31	c		0	255	Yes	Yes	No	Yes	Yes	0	Fluidset properties

Parameter number (DDE)	Parameter name	Group 0	Group 1	Group 2	Process number	FB nr (par)	Var Type	Var Length	Min value	Max value	Read	Write	Poll	Secured	Highly Secured	Default Value	Description
239	LUnitType	3			33	12	c		0	255	Yes	Yes	No	Yes	Yes	0	Lookup table capacity unit type
240	LUnTypNam	3			33	13	c	20			Yes	Yes	No	Yes	Yes		Lookup table capacity unit type name
241	LUnit	3			33	16	c		0	255	Yes	Yes	No	Yes	Yes	0	Lookup table capacity unit (unit LUTy)
242	LUnitName	3			33	17	c	7			Yes	Yes	No	Yes	Yes	kg/s	Lookup table capacity unit name
243	CUnitType	3				29	c		0	255	Yes	Yes	No	Yes	No	0	Output capacity unit type
244	CUnTypNam	3				30	c	20			Yes	Yes	No	Yes	No		Output capacity unit type name
245	CUnTypTem	3			33	10	f		-273.15	3.4028E+38	Yes	Yes	No	Yes	No	0	Output capacity unit type temperature (°C)
246	CUnTypPres	3			33	11	f		0	3.4028E+38	Yes	Yes	No	Yes	No	1	Output capacity unit type pressure (bar (a))
247	CapMin	3				27	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0	Minimum capacity in output capacity units
248	CapMax	3				28	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	1	Maximum capacity in output capacity units
249	FormulaTyp	3			113	17	i		0	65535	Yes	Yes	No	Yes	No	0	Formula type needed for conversion
250	HeatCap	3			113	18	f		0	3.4028E+38	Yes	Yes	No	Yes	No	0	Heat capacity (Cp) (sensor conditions)
251	ThermCond	3			113	20	f		0	3.4028E+38	Yes	Yes	No	Yes	No	0	Thermal conductivity (sensor conditions)
252	Viscosity	3			113	21	f		0	3.4028E+38	Yes	Yes	No	Yes	No	0	Dynamic viscosity (fluid conditions)
253	NormMasFlw	3			113	22	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	1	Normalized mass flow in ln/min air equivalent
254	Kspeed	8	3		114	30	f		0	3.4028E+38	Yes	Yes	No	Yes	No	1	Controller speed factor (gain)
255	SensorCode	13			113	23	i		0	65535	Yes	Yes	No	Yes	Yes	0	Sensor code
256	SensorRevC	13			113	24	c		0	255	Yes	Yes	No	Yes	Yes	0	Sensor revision code
257	RestrCode	13			113	25	i		0	65535	Yes	Yes	No	Yes	Yes	0	Restriction code
258	RestrRevC	13			113	26	c		0	255	Yes	Yes	No	Yes	Yes	0	Restriction revision code
259	RestrNxP	13			113	27	l		0	2147483648	Yes	Yes	No	Yes	Yes	0	Restriction NxP (proportional to air equivalent capacity of LFE)
260	Seals	13			113	28	c	16	0	255	Yes	Yes	No	Yes	Yes	V,V	Seals information (1st byte = other, 2nd = plunger seal)
261	ValveCode	13			113	29	i		0	65535	Yes	Yes	No	Yes	Yes	0	Valve code
262	ValveRevC	13			113	30	c		0	255	Yes	Yes	No	Yes	Yes	0	Valve revision code
263	InstrProp	13			113	31	l		0	2147483648	Yes	Yes	No	Yes	Yes	0	Instrument properties
264	LookFreqI	3			116	10	c		0	1	Yes	Yes	No	Yes	No	0	Lookup table for frequency index
265	LFFreq	3			116	11	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0	Lookup table for frequency frequency
266	LFTemp	3			116	12	f		-273.15	3.4028E+38	Yes	Yes	No	Yes	No	0	Lookup table for frequency temperature
267	LFDensity	3			116	13	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0	Lookup table for frequency density
268	LFSpanAdj	3			116	14	f		-3.4028E+38	3.4028E+38	Yes	Yes	No	Yes	No	0	Lookup table for frequency span adjust
269	CUnit	3	19		65	15	c		0	255	Yes	Yes	No	Yes	No	0	Capacity unit index (new unit table)
270	DensityAct	3			116	15	f		-3.4028E+38	3.4028E+38	Yes	No	No	No	No	0	Actual density, measured by instrument
271	RestrMeas	13			116	18	f		0	3.4028E+38	Yes	Yes	No	Yes	No	0	Measured restriction
272	TempPotm	3			116	8	c		0	255	Yes	Yes	No	Yes	No	0	Potmeter for sensor temperature compensation
273	TempGain	3			116	9	c		0	255	Yes	Yes	No	Yes	No	0	Potmeter for sensor gain

APPENDIX 2

Parameter values table

Parameter values table

Parameter number (DDE)	Parameter name	Filter	Value	Description
6	arbitrage		1	temporary busmaster
6	arbitrage		2	always busmaster
6	arbitrage		3	automatic busmaster
6	arbitrage		67	auto busmaster and auto bus optimalization (fast token ring)
12	cntrlmode		0	setpoint = BUS setpoint
12	cntrlmode		1	setpoint = analog input
12	cntrlmode		2	setpoint = master output(FLOW-BUS) * slave factor(FLOW-BUS)
12	cntrlmode		3	close valve
12	cntrlmode		4	setpoint idle (no reaction on changes in sensor signal)
12	cntrlmode		5	testmode enable (select subject with par 70)
12	cntrlmode		6	tuningmode enable (select subtject with par 79)
12	cntrlmode		7	setpoint = 100%
12	cntrlmode		8	purge valve (fully open)
12	cntrlmode		9	calibration mode enable (select subject with par 58)
12	cntrlmode		10	setpoint = master output(analog in) * slave factor(FLOW-BUS)
12	cntrlmode		11	setpoint = keyboard OR FLOW-BUS setpoint
12	cntrlmode		12	setpoint = 0%
12	cntrlmode		13	setpoint = master output(FLOW-BUS) * slave factor(analog in)
12	cntrlmode		14	(FPP) Range select mode
12	cntrlmode		15	(FPP) Manual start sensor select, automatic end sensor
12	cntrlmode		16	(FPP) Automatic start sensor select, manual end sensor
12	cntrlmode		17	(FPP) Automatic start and end sensor
12	cntrlmode		18	setpoint = RS232 setpoint
12	cntrlmode		19	RS232 broadcast mode
12	cntrlmode		20	valve stearing (valve = setpoint)
12	cntrlmode		21	analog valve stearing (valve = analog setpoint)
22	sensortype		0	pressure (controller)
22	sensortype		1	liquid volume (controller)
22	sensortype		2	liquid/gas mass (controller)
22	sensortype		3	gas volume (controller)
22	sensortype		4	other sensor type (controller)
22	sensortype		128	pressure (sensor)
22	sensortype		129	liquid volume (sensor)
22	sensortype		130	liquid/gas mass (sensor)
22	sensortype		131	gas volume (sensor)
22	sensortype		132	other sensor type (sensor)
28	alarminfo	&H01	0	no error message in alarm error status register
28	alarminfo	&H01	1	at least 1 error message in alarm error status register
28	alarminfo	&H02	0	no warning message in alarm warning status register
28	alarminfo	&H02	1	at least 1 warning message in alarm warning status register
28	alarminfo	&H04	0	no minimum alarm message (measure>minimum limit)
28	alarminfo	&H04	1	minimum alarm message for measured signal
28	alarminfo	&H08	0	no maximum alarm message (measure<maximum limit)
28	alarminfo	&H08	1	maximum alarm message for measured signal
28	alarminfo	&H10	0	batch counter has not reached its limit
28	alarminfo	&H10	1	batch counter has reached its limit
28	alarminfo	&H20	0	response O.K. (setpoint-measure within limit)
28	alarminfo	&H20	1	response alarm message: setpoint-measure is too high
28	alarminfo	&H40	0	master output signal O.K. (or not used)
28	alarminfo	&H40	1	master output signal not received: check master instrument
28	alarminfo	&H80	0	hardware O.K.
28	alarminfo	&H80	1	hardware error message: check your hardware
44	opermodeTA		0	OFF
44	opermodeTA		1	A: MAX & RESP AUTO; T: UP TO LIMIT
44	opermodeTA		2	A: MIN & RESP AUTO; T: UP AND REPEAT
44	opermodeTA		3	A: MAX & RESP; T: DOWN FROM LIMIT
44	opermodeTA		4	A: MIN & RESP; T: DOWN AND REPEAT
44	opermodeTA		5	A: MAXIMUM ALARM; T: ALWAYS UP
44	opermodeTA		6	A: MINIMUM ALARM
44	opermodeTA		7	A: RESPONSE ALARM
53	AnalogMode	&H3F	0	0...5 Vdc operation
53	AnalogMode	&H3F	1	0...10 Vdc operation
53	AnalogMode	&H3F	2	0...20 mA operation
53	AnalogMode	&H3F	3	4...20 mA operation
53	AnalogMode	&H3F	4	15...20 mA operation
53	AnalogMode	&H40	0	Analog input enabled
53	AnalogMode	&H40	1	Analog input disabled
53	AnalogMode	&H80	0	Analog output enabled
53	AnalogMode	&H80	1	Analog output disabled
58	CalMode		0	idle: no action
58	CalMode		1	adc self calibration
58	CalMode		2	dmfc
58	CalMode		3	dmfc

Parameter number (DDE)	Parameter name	Filter	Value	Description
58	CalMode		4	dmfc
58	CalMode		5	dmfc
58	CalMode		6	dmfc
58	CalMode		7	dmfc
58	CalMode		8	dmfc
58	CalMode		9	zero sensor bridge circuit
58	CalMode		10	adjust Vref output by connecting it to analog in
58	CalMode		11	adjust analog out by connecting it to analog in
58	CalMode		12	adjust valveoutput by connecting it to analog in
58	CalMode		13	dmfc
58	CalMode		14	dmfc
58	CalMode		15	analog output = 0 %
58	CalMode		16	analog output = 100 %
58	CalMode		17	analog output = 50 %
58	CalMode		18	adjust heater balance
58	CalMode		19	sensor differentiator (setpoint steps are needed!)
58	CalMode		255	Error mode (result of previous cal mode)
60	monitor		0	(filtered) setpoint
60	monitor		1	controller error input signal
60	monitor		2	controller output signal to valve
60	monitor		3	sensor signal slow
60	monitor		4	sensor signal slow filtered
60	monitor		5	linearization output
60	monitor		6	differentiator output
60	monitor		7	differentiator output filtered
60	monitor		8	normal sensor signal (Output)
60	monitor		9	analog input signal
60	monitor		10	power supply voltage
60	monitor		11	mass flow in display unit (normally ln/min)
60	monitor		12	volume flow in l/min
60	monitor		13	temperature in °C
60	monitor		14	pressure absolute in mbara
60	monitor		15	time in msec/frequency in Hz.
60	monitor		16	calibrated volume at actual sensor in ml
60	monitor		17	delta-P pressure in mbarg
60	monitor		18	atmospheric (barometer) pressure in mbara
60	monitor		19	mass flow in kg/min
61	AlarmReg1	&H8000000000000000	0	No diagnostics available in warning register
61	AlarmReg1	&H8000000000000000	1	Diagnostics available in warning register
62	AlarmReg2	&H8000000000000000	0	No diagnostics available in error register
62	AlarmReg2	&H8000000000000000	1	Diagnostics available in error register
67	ADCcntrReg	&H001000	0	ADC bipolar mode
67	ADCcntrReg	&H001000	1	ADC unipolar mode
67	ADCcntrReg	&H002000	0	ADC burn-out current off
67	ADCcntrReg	&H002000	1	ADC burn-out current on
67	ADCcntrReg	&H004000	0	ADC output compensation current off
67	ADCcntrReg	&H004000	1	ADC output compensation current on
67	ADCcntrReg	&H008000	0	ADC 16-bit word length
67	ADCcntrReg	&H008000	1	ADC 24-bit word length
67	ADCcntrReg	&H010000	0	ADC no power down mode (normal)
67	ADCcntrReg	&H010000	1	ADC power down mode
67	ADCcntrReg	&H020000	0	ADC input channel 1 selection
67	ADCcntrReg	&H020000	1	ADC input channel 2 selection
67	ADCcntrReg	&H1000000	0	Disable zero measure threshold
67	ADCcntrReg	&H1000000	1	Enable zero measure threshold
67	ADCcntrReg	&H1C0000	0	ADC gain = 1x
67	ADCcntrReg	&H1C0000	1	ADC gain = 2x
67	ADCcntrReg	&H1C0000	2	ADC gain = 4x
67	ADCcntrReg	&H1C0000	3	ADC gain = 8x
67	ADCcntrReg	&H1C0000	4	ADC gain = 16x
67	ADCcntrReg	&H1C0000	5	ADC gain = 32x
67	ADCcntrReg	&H1C0000	6	ADC gain = 64x
67	ADCcntrReg	&H1C0000	7	ADC gain = 128x
67	ADCcntrReg	&HE00000	0	ADC normal (sampling) mode
67	ADCcntrReg	&HE00000	1	ADC activate self calibration on selected channel
67	ADCcntrReg	&HE00000	2	ADC activate system calibration ZS on selected channel
67	ADCcntrReg	&HE00000	3	ADC activate system calibration FS on selected channel
67	ADCcntrReg	&HE00000	4	ADC activate system offset calibration on selected channel
67	ADCcntrReg	&HE00000	5	ADC activate background calibration on selected channel
67	ADCcntrReg	&HE00000	6	ADC read/write ZS calibration coefficients on sel. channel
67	ADCcntrReg	&HE00000	7	ADC read/write FS calibration coefficients on sel. channel
69	AlarmEnble		0	disable
69	AlarmEnble		1	enable
70	TestMode		0	idle; no action
70	TestMode		1	uProcessor
70	TestMode		2	IO
70	TestMode		3	RAM
70	TestMode		4	FRAM

Parameter number (DDE)	Parameter name	Filter	Value	Description
70	TestMode		5	ADC
70	TestMode		6	DAC
70	TestMode		7	sensor
70	TestMode		8	valve drive circuit
70	TestMode		9	Vref
70	TestMode		10	FLOW-BUS
70	TestMode		11	calibration
70	TestMode		12	keyboard
71	ChanSelect		1	AD channel 1
71	ChanSelect		2	AD channel 2
79	TuningMode		0	idle; no action
79	TuningMode		1	sensor
79	TuningMode		2	valve
79	TuningMode		3	Fuzzy controller normal operation
79	TuningMode		4	Fuzzy controller open at zero
79	TuningMode		5	PID controller
80	DefVlvType		0	normally closed
80	DefVlvType		1	normally opened
80	DefVlvType		2	normally closed inverse controlled
80	DefVlvType		3	normally opened inverse controlled
80	DefVlvType		4	remain position
86	IOStatus	&H01	1	don't read diagnostic jumper (no diagnostics, read/write)
86	IOStatus	&H02	1	not used
86	IOStatus	&H03	0	Red LED off) (<MBC7.15)
86	IOStatus	&H03	1	don't read analog jumper (use cntrlmode, read/write) (<7.15)
86	IOStatus	&H03	3	Red LED blinking fast) (<MBC7.15)
86	IOStatus	&H04	1	don't read analog jumper (use cntrlmode, read/write)
86	IOStatus	&H08	1	don't read micro switch (always off, read/write)
86	IOStatus	&H10	1	diagnostic jumper set (read only)
86	IOStatus	&H20	1	initialization jumper set (read only)
86	IOStatus	&H40	1	analog jumper set (read only)
86	IOStatus	&H80	1	micro switch pressed (read only)
106	PressSensr		0	delta-P 0..5" W.C.
106	PressSensr		1	delta-P 0...10" W.C.
106	PressSensr		2	absolute pressure 800-1200 mbar
106	PressSensr		3	absolute pressure 800-1100 mbar
106	PressSensr		4	delta-P -5...0 "W.C.
106	PressSensr		5	delta-P -10...0 "W.C.
106	PressSensr		6	delta-P -10...+10 "W.C.
106	PressSensr		7	delta-P 0...1 PSI
106	PressSensr		8	delta-P -1...0 PSI
114	Reset		0	no reset
114	Reset		1	reset counter value (no mode change) or common reset
114	Reset		2	reset alarm
114	Reset		3	restart batch counter
114	Reset		4	reset counter value (counter off)
114	Reset		5	Reset module (soft reset)
118	AlrmMode		0	off
118	AlrmMode		1	alarm on absolute limits
118	AlrmMode		2	alarm on limits related to setpoint (response alarm)
118	AlrmMode		3	alarm when instrument powers-up (eg. after power-down)
119	AlrmOutMod		0	no relais activity at alarm
119	AlrmOutMod		1	relais pulses until reset
119	AlrmOutMod		2	relais activated until reset
120	AlrmStpMod		0	no setpoint change at alarm
120	AlrmStpMod		1	new/safe setpoint at alarm enabled (set at par 121)
125	CntrOutMod		0	no relais activity at batch limit
125	CntrOutMod		1	relais pulses after reaching batch limit until reset
125	CntrOutMod		2	relais activated after reaching batch limit until reset
126	CntrStpMod		0	setpoint change at batch limit disabled
126	CntrStpMod		1	setpoint change at batch limit enabled
130	CntrMode		0	off
130	CntrMode		1	counting upwards continuously
130	CntrMode		2	counting up to limit (batchcounter)
147	rangeselct		0	calibration ready/stop
147	rangeselct		1	run calibration until stopsensor 1/select range 1
147	rangeselct		2	run calibration until stopsensor 2/select range 2
147	rangeselct		3	run calibration until stopsensor 3/select range 3
147	rangeselct		4	run calibration until stopsensor 4/select range 4
147	rangeselct		5	run calibration and select range 5
147	rangeselct		9	run calibration with automatic range selection
147	rangeselct		19	run until stopsensor 1 until 3 values between limit
147	rangeselct		29	run until stopsensor 2 until 3 values between limit
147	rangeselct		39	run until stopsensor 3 until 3 values between limit
147	rangeselct		49	run until stopsensor 4 until 3 values between limit
147	rangeselct		59	run and select range 5 until 3 values between limit
147	rangeselct		99	run with auto-select + 3 values between limit
156	RstAlarmEn		0	no reset possible

Parameter number (DDE)	Parameter name	Filter	Value	Description
156	RstAlarmEn		1	reset: keyboard
156	RstAlarmEn		2	reset: external
156	RstAlarmEn		3	reset: keyboard or external
156	RstAlarmEn		4	reset: FLOW-BUS
156	RstAlarmEn		5	reset: FLOW-BUS or keyboard
156	RstAlarmEn		6	reset: FLOW-BUS or external
156	RstAlarmEn		7	reset: FLOW-BUS or keyboard or external
156	RstAlarmEn		8	reset: automatic
156	RstAlarmEn		9	reset: automatic or keyboard
156	RstAlarmEn		10	reset: automatic or external
156	RstAlarmEn		11	reset: automatic or keyboard or external
156	RstAlarmEn		12	reset: automatic or FLOW-BUS
156	RstAlarmEn		13	reset: automatic or FLOW-BUS or keyboard
156	RstAlarmEn		14	reset: automatic or FLOW-BUS or external
156	RstAlarmEn		15	reset: automatic or FLOW-BUS or keyboard or external
157	RstCountEn		0	no reset possible
157	RstCountEn		1	reset: keyboard
157	RstCountEn		2	reset: external
157	RstCountEn		3	reset: keyboard or external
157	RstCountEn		4	reset: FLOW-BUS
157	RstCountEn		5	reset: FLOW-BUS or keyboard
157	RstCountEn		6	reset: FLOW-BUS or external
157	RstCountEn		7	reset: FLOW-BUS or keyboard or external
157	RstCountEn		8	reset: automatic
157	RstCountEn		9	reset: automatic or keyboard
157	RstCountEn		10	reset: automatic or external
157	RstCountEn		11	reset: automatic or keyboard or external
157	RstCountEn		12	reset: automatic or FLOW-BUS
157	RstCountEn		13	reset: automatic or FLOW-BUS or keyboard
157	RstCountEn		14	reset: automatic or FLOW-BUS or external
157	RstCountEn		15	reset: automatic or FLOW-BUS or keyboard or external
166	ContrType	&H01	0	valve in normal position after startup
166	ContrType	&H01	1	valve in safe position after startup
166	ContrType	&H02	0	open from zero with PID output to valve
166	ContrType	&H02	1	open from zero with ramp output to valve
166	ContrType	&H04	0	fixed monitor output signal
166	ContrType	&H04	1	monitor output changed at setpoint steps
166	ContrType	&H08	0	voltage drift compensation for valve output turned on
166	ContrType	&H08	1	voltage drift compensation for valve output turned off
166	ContrType	&H10	0	auto slope disabled
166	ContrType	&H10	1	auto slope enabled for pilot valves
166	ContrType	&H20	0	voltage drift compensation for valve output turned on
166	ContrType	&H20	1	voltage drift compensation for valve output turned off
166	ContrType	&H40	0	controller special mode (valve output steps) turned off
166	ContrType	&H40	1	controller special mode (valve output steps) turned on
175	IdenrNr		0	UFO?: Unidentified FLOW-BUS Object
175	IdentNr		1	RS232/FLOW-BUS interface
175	IdentNr		2	PC(ISA) interface
175	IdentNr		3	ADDA4 (4 channels)
175	IdentNr		4	R/C-module, 32 channels
175	IdentNr		5	T/A-module
175	IdentNr		6	ADDA1: 1 channel ADDA converter module
175	IdentNr		7	DMFC: digital mass flow controller
175	IdentNr		8	DMFM: digital mass flow meter
175	IdentNr		9	DEPC: digital electronic pressure controller
175	IdentNr		10	DEPM: digital electronic pressure meter
175	IdentNr		11	ACT: single actuator
175	IdentNr		12	DLFC: digital liquid flow controller
175	IdentNr		13	DLFM: digital liquid flow meter
175	IdentNr		14	DSCM-A: digital single channel module for analog instruments
175	IdentNr		15	DSCM-D: digital single channel module for digital instr.
175	IdentNr		16	FRM: FLOW-BUS rotor meter (calibration-instrument)
175	IdentNr		17	FTM: FLOW-BUS turbine meter (calibration-instrument)
175	IdentNr		18	FPP: FLOW-BUS piston prover/tube (calibration-instrument)
175	IdentNr		19	F/A-module: special version of T/A-module
175	IdentNr		20	DSCM-E: evaporator controller module (single channel)
175	IdentNr		21	DSCM-C: digital single channel module for calibrators
175	IdentNr		22	DDCM-A: digital dual channel module for analog instruments
175	IdentNr		23	DMCM-D: digital multi channel module for digital instruments
175	IdentNr		24	Profibus-DP/FLOW-BUS interface module
175	IdentNr		25	FLOW-BUS Coriolis Meter
175	IdentNr		26	FBI: FLOW-BUS Balance Interface
175	IdentNr		27	CORIFC: CoriFlow Controller
175	IdentNr		28	CORIFM: CoriFlow Meter
175	IdentNr		29	FICC: FLOW-BUS Interface Climate Control
175	IdentNr		30	IFI: Instrument FLOW-BUS Interface
175	IdentNr		31	KFI: Keithley FLOW-BUS Interface
175	IdentNr		32	FSI: FLOW-BUS Switch Interface

Parameter number (DDE)	Parameter name	Filter	Value	Description
175	IdentNr		33	MSCI: Multi-Sensor/Confroller Interface
185	DeviceFunc		0	Unknown
185	DeviceFunc		1	Interface
185	DeviceFunc		2	ADDA
185	DeviceFunc		3	Operator
185	DeviceFunc		4	Supervisor (totalizer/alarm)
185	DeviceFunc		5	Controller
185	DeviceFunc		6	Meter
185	DeviceFunc		7	Special
185	DeviceFunc		8	(Protocol) converter
197	CalType	&H01	0	Automatic capacity setting for optimal resolution
197	CalType	&H01	1	Manual capacity setting for optimal resolution
197	CalType	&H02	0	Barometer value input via parameter 107: BaroPress
197	CalType	&H02	1	Barometer is master; input automatically from master
200	InterfConf		0	Configuration A: 14 ch. Standard parms. with network scan
200	InterfConf		1	Configuration B: 14 ch. Standard parms with fixed chan list
200	InterfConf		2	Configuration C: 7 ch. Extended parms with fixed chan list
200	InterfConf		3	Configuration D: 11 ch. Extended parms with network scan
208	Mstatus	&H800000	0	No diagnostics available in manufacturer status register
208	Mstatus	&H800000	1	Diagnostics available in manufacturer status register
209	Mwarning	&H800000	0	No diagnostics available in manufacturer warning register
209	Mwarning	&H800000	1	Diagnostics available in manufacturer warning register
210	Merror	&H800000	0	No diagnostics available in manufacturer error register
210	Merror	&H800000	1	Diagnostics available in manufacturer error register
212	DiagMode		0	Debug mode off
212	DiagMode		1	Debug mode on
213	MStatEnabl		0	set status bit (range 0…127)
213	MStatEnabl		127	set status bit (range 0…127)
213	MStatEnabl		254	clear all status bits
213	MStatEnabl		255	set all status bits
232	ValveMode		0	voltage drive mode
232	ValveMode		1	current drive mode
238	FldSetProp	&H01	0	Fluidset is disabled
238	FldSetProp	&H01	1	Fluidset is enabled
238	FldSetProp	&H02	0	Fluidset is not set by Bronkhorst High-Tech
238	FldSetProp	&H02	2	Fluidset is set by Bronkhorst High-Tech
238	FldSetProp	&H04	0	Fluidset is not calibrated on actual gas
238	FldSetProp	&H04	4	Fluidset is calibrated on actual gas